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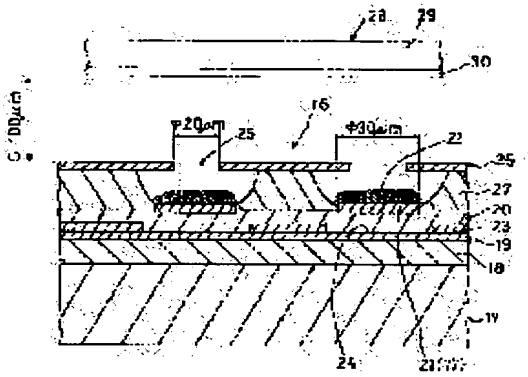
## (54) ION WRITE HEAD

(57)Abstract:
PURPOSE: To provide an ion write head which has high ion utility efficiency in a small size.
CONSTITUTION: An ion write head 16 forms an electrostatic image by selectively adhering charged particles on a latent image carrier 28 formed of dielectric unit, and comprises a plurality of individual electrodes 21 formed on a board 17, an electron emitting unit 22 which is formed on the electrodes 21 and can emit electrons to form the particles by heating, a heater 24 for heating the unit 22, and a gate electrode 26 for accelerating the electrons emitted from the unit 22.

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CLAIMS

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[Claim(s)]
[Claim 1] Two or more individual electrodes which are the ion write head which a charged particle is made to adhere selectively and forms an electrostatic latent image on the latent-image support constituted with a dielectric, and were formed on the substrate, The electron emission section which may emit the electron for generating a charged particle by being formed on said individual electrode and heated, The ion write head characterized by having a heating unit for heating said electron emission section, and a gate electrode for accelerating the electron which collaborated with said individual electrode and was emitted from said electron emission section.
[Claim 2] The ion write head according to claim 1 characterized by said individual electrode making said heating unit serve a double purpose.
[Claim 3] The ion write head according to claim 1 or 2 characterized by forming said electron emission section considering a ferroelectric as a subject.
[Claim 4] The ion write head given in any 1 term of claim 1 characterized by having the actuation circuit which makes said heating unit generate heat to predetermined timing thru/or claim 3.

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the suitable ion write head for the electrostatic recording equipment which the charged particle corresponding to an image is made to adhere selectively from the exterior, and forms an electrostatic latent image on the latent-image support constituted with a dielectric.
[0002]
[Description of the Prior Art] While the mechanical reinforcement of latent-image support is high in recent years as compared with the photo conductor used as latent-image support in the conventional electrophotography method and using the latent-image support formed with the dielectric which is excellent also in the stability over temperature or a repeat At high speed, the printer of the ion write-in formula which forms an electrostatic latent image using a charged particle (ion) instead of the conventional light has dramatically much printing number of sheets, and is used abundantly at few [ the frequency of a maintenance ] business-use high-speed printers etc. And since control of latent-image potential is easy as compared with the printer of the electrophotography method which used the photo conductor, by controlling the coating weight of developers, such as a toner, the printer of an ion write-in formula is suitable for printing which has concentration gradation, and suitable for the full color printer than to which greater importance is attached to the repeatability of concentration gradation.
[0003] Hereafter, such the conventional ion write head is explained.
[0004] Drawing 22 shows an example of the conventional ion write head, (a) is the perspective view showing the whole configuration, and (c) is [ (b) is drawing of longitudinal section showing the configuration of an important section, and ] the explanatory view showing the arrangement condition of a line electrode and a finger electrode.
[0005] As shown in (a) of drawing 22 , the screen electrode 2 is formed on the surface of one side, two or more openings 3 are arranged and formed in the front face serrate, and the conventional ion write head 1a is made abbreviation plate-like as a whole. And as shown in (b) of drawing 22 , the screen electrode 2, the finger electrode 4 with opening 3, and the line electrode 5 are arranged through the insulating layer 6 which consists of a desired dielectric, respectively. Moreover, as shown in (c) of drawing 22 , the opening 3 of the finger electrode 4 and the line electrode 5 are arranged in the shape of a matrix. And as shown in (b) of drawing 22 , each opening 3 is arranged in it as ion write head 1a counters the latent-image support 7.
[0006] In such conventional ion write head 1a, by the actuation circuit of the request which is not illustrated between the finger electrode 4 and the line electrode 5, the frequency of 1MHz and about [ electrical-potential-difference 1kV ] high-frequency voltage are impressed, and the ion 8 ((b) of drawing 22 ) as a charged particle by discharge is generated in the atmospheric air of the circumference of the finger electrode 4. Moreover, as shown in (c) of drawing 22 , two or more line electrodes 5 are formed, and high-frequency voltage is impressed to one of them one by one. And the direct current voltage of -600V is impressed to the screen electrode 2, and the electrical potential difference of -400V

is impressed to the finger electrode 4 at the time of -700V and printing at the time of standby. Furthermore, pulse width at the time of printing is made about [ 20micro ] into S, and for example, it generated in the atmospheric air of the circumference of the finger electrode 4, the polar ion 8 of minus is controlled by the screen electrode 2, and it is made to collide with the latent-image support 7 through opening 3, as shown in (b) of drawing 22 .

[0007] Said latent-image support 7 is used as the so-called dielectric drum 11 on which the desired dielectric layer 10 was formed in the front face of the metal drum 9 as shown in (b) of drawing 22 , and said metal drum 9 is grounded. And as mentioned above, the electrostatic latent image corresponding to the image of the request which is not illustrated is formed in the front face of the dielectric drum 11 by making the polar ion 8 of minus as a charged particle collide with the front face of the dielectric drum 11.

[0008] The conventional ion write head 1b of other examples is shown, in this conventional ion write head 1b, corotron 12 is used for generating of the ion 8 as a charged particle, the control electrodes 14 and 14 of two sheets which have two or more desired openings 13 in that front face are arranged, and drawing 23 is driven by the proper actuation circuit 15. And it is controlled whether the ion 8 8 generated in corotron 12, for example, the ion of a plus polarity, makes it reach from opening 13 to the latent-image support 7 with the polarity of the electrical potential difference applied among the control electrodes 14 and 14 of two sheets. Moreover, distance between the control electrodes 14 and 14 of two sheets is set to about 100 micrometers, and the diameter of opening 13 is set to about 200 micrometers. Furthermore, resolution of ion write head 1b is carried out in about 8 dots/mm. Moreover, said opening 13 is arranged by serrate like the opening 3 of head 1a shown in (a) of drawing 22 mentioned above.

[0009]

[Problem(s) to be Solved by the Invention] However, in the conventional ion write head 1 (a sign names generically the conventional ion write heads 1a and 1b) mentioned above, since it is impossible to make latent-image formation generate the ion 8 of only a complement on real time, a lot of ion 8 is always generated, the part is drawn on the latent-image support 7 by the screen electrode 2 or the control electrode 14 of two sheets, and 14 grades, and an electrostatic latent image is formed. For this reason, the utilization effectiveness of the generated ion 8 was low, and there were various troubles of processing of the ozone generated simultaneously with ion 8, buildup of power consumption, enlargement of a head 1, enlargement, formation of an expensive rank of the actuation circuit 15 for control electrodes that controls high tension, etc.

[0010] Moreover, in the conventional ion write head 1, there was a trouble that the minimum of the magnitude of the openings 3 and 13 which ion 8 passes had constraint. One of the constraint of this is for enlarging utilization effectiveness of the generated ion 8, I hear that another must make the process tolerance and isolation voltage of the screen electrode 2 which impresses high tension, or a control electrode 14 hold, and there is.

[0011] That is, the trouble of using the screen electrode 2 or control electrode 14 which has the big openings 3 and 13 is a point that the diameter of 1 dot of the electrostatic latent image formed when the point that the absolute value of control voltage becomes large, and the ion 8 (ionic current) which flows toward the latent-image support 7 from the ion write head 1 are extracted does not become small enough. In extracting an ionic current, the diameter of an ionic current converges on about [ of the diameter of the openings 3 and 13 of control electrodes 2 and 14 / 1/several ] for the electrical potential difference which joins electrodes 2 and 14. For this reason, the diameter of 1 dot of the electrostatic latent image formed becomes small compared with an increase or the case where it carries out, about an ionic current. However, the potential of the electrostatic latent image at the time of extracting an ionic current for the limitation of the rate of focusing serves as an in-between value, and will reproduce halftone with potential.

[0012] Moreover, although the repeatability in the case of area gradation is good when reproducing concentration gradation with the coating weight of a toner, the repeatability in the case of concentration gradation does not have so good repeatability by factors, such as dispersion in the amount of electrifications of a toner. Generally, it is said that the conventional ion write head 1 is excellent in the

repeatability of concentration gradation compared with other write-in methods. Although the repeatability and stability of gradation in case many flow rates of ion 8 go into the field of area gradation are excellent if it sees strictly about this repeatability, the tone reproduction at the time of extracting the flow rate of ion 8 is inferior compared with the high concentration field. And when not changing but reproducing gradation by change of potential, there cannot but be many factors which degrade the grace of images, such as dispersion in the coating weight of a toner, at a development process, and the area of an electrostatic latent image cannot but become what was inferior to the tone reproduction in area gradation as a result, even if formation of an electrostatic latent image is performed to accuracy to an input signal.

[0013] That magnitude of said openings 3 and 13 cannot be made small has the trouble of the constraint on the design of not comparing openings 3 and 13 with the ability of resolution not being raised on a straight line.

[0014] Generally, although the quality of printed character of fixed level can be obtained to the repeatability of the binary picture of white and black also in the printer of an electrophotography method, the repeatability of an image including halftone is not good. Then, in a current electrophotography method, the approach of reproducing halftone in false is in use with the area gradation using a dither, and the resolution of printing at the time of using a dither falls substantially compared with the resolution in electrostatic latent-image means forming.

[0015] The matrix of a typical dither is formed by 4x4 pixels or about 6x6 pixels. The tone reproduction in that case becomes 16 steps and 36 steps, and the resolution of the image formed is set to 1/4 or 1/6. When thinking a tone reproduction as important, in order to obtain practical resolution, it is necessary to form an electrostatic latent image with dramatically high resolution.

[0016] In the printer using the conventional ion write head 1, since the repeatability of halftone is excellent, the rendering of concentration gradation is possible also for not depending on a dither, either. Therefore, it has been thought that the trouble that resolution cannot be raised because of a limit of the magnitude of openings 3 and 13 etc. is suppliable with the repeatability of concentration gradation. That is, in the application over which priority is given to a tone reproduction like a photograph, even if resolution was low, when the tone reproduction was excellent, repeatability was suppliable, but in the application as which high resolution, such as printing of an alphabetic character, is required, though some improvements could be made using the tone reproduction, there was a trouble that only the quality of printed character which was substantially inferior to the electrophotography method with high resolution was obtained.

[0017] Moreover, it sets to the conventional ion write head 1. Two or more openings 3 and 13 cannot be formed in the print width direction in a straight line. Two or more openings 3 and 13 were arranged aslant, and when the method which forms the electrostatic latent image of one line in time sharing was used, the nonuniformity of a rate was in the latent-image support 7 or the timing of writing shifted to it, there was a trouble that the location of an electrostatic latent image shifted and a quality of printed character deteriorated substantially. Moreover, a control circuit, the actuation circuit 15, etc. which are not illustrated tended to become complicated and expensive by rearrangement of an image, generating of timing, etc., ion write head 1 the very thing was enlarged, and there was a trouble that it became difficult to keep constant the distance between the ion write head 1 and the latent-image support 7.

[0018] This invention is made in view of these points, and the trouble in the conventional thing mentioned above is conquered, and it is small and aims at offering the ion write head with the high utilization effectiveness of ion.

[0019]

[Means for Solving the Problem] In order to attain the object mentioned above the ion write head of this invention according to claim 1 Two or more individual electrodes which are the ion write head which a charged particle is made to adhere selectively and forms an electrostatic latent image on the latent-image support constituted with a dielectric, and were formed on the substrate, The electron emission section which may emit the electron for generating a charged particle by being formed on said individual electrode and heated, It is characterized by having a heating unit for heating said electron emission

section, and a gate electrode for accelerating the electron which collaborated with said individual electrode and was emitted from said electron emission section.
[0020] And the ion write head of this invention according to claim 2 is characterized by said individual electrode making said heating unit serve a double purpose in claim 1.
[0021] Furthermore, the ion write head of this invention according to claim 3 is characterized by forming said electron emission section considering a ferroelectric as a subject in claim 1 or claim 2.
[0022] Moreover, the ion write head of this invention according to claim 4 is characterized by having the actuation circuit which makes said heating unit generate heat to predetermined timing in any 1 term of claim 1 thru/or claim 3.
[0023]
[Function] The ion write head of this invention which consists of a configuration mentioned above By generating ion using the so-called principle of thermionic emission, and heating the heating unit formed on the substrate Heat the electron emission section, make a thermoelectron emit from here, accelerate by the electric field to which this electron is impressed between the gate electrode and the individual electrode, and ion is generated. It can be made to be able to move to the front face of latent-image support by the electric field to which this ion is impressed between an individual electrode and latent-image support, and an electrostatic latent image can be formed in the front face of latent-image support.
[0024]
[Example] Hereafter, the example which shows this invention to a drawing explains.
[0025] Drawing 3 shows the 1st example of the ion write head concerning this invention from drawing 1 , drawing 1 is drawing of longitudinal section showing the configuration of an important section, it is a cutting top view a part and drawing 2 is a circuit diagram showing the configuration of an important section in which drawing 3 shows an actuation circuit.
[0026] As shown in drawing 1 and drawing 2 , the heat insulating layer 18 is arranged on the substrate 17, and, as for the ion write head 16 of this example, the heater layer 19 is arranged in the top face of this heat insulating layer 18. And it is called two or more cathode electrodes which corresponded to resolution (pixel number) through the medium insulating layer 20 on the top face of the heater layer 19, for example, alignment arrangement of the individual electrode 21 which has the base 77 with a diameter of about 30 micrometers is carried out in drawing at the longitudinal direction (the print width direction) at the shape of a single tier. Furthermore, the electron emission section 22 which may emit the electron for generating a charged particle (ion) is arranged in the top face of the base 77 of the electrode 21 according to each. Moreover, the conductive layer 23 for centralizing generation of heat of the heater layer 19 to each electron emission section 22 is arranged in the top face of the heater layer 19 except for the part which counters each electron emission section 22. That is, let the part which is not covered with the conductive layer 23 corresponding to each electron emission section 22 of the heater layer 19 be the heating unit 24 for heating each electron emission section 22 in this example. On a substrate 17, it centered on each electron emission section 22, for example, the gate electrode 26 which has the circular opening 25 with a diameter of about 20 micrometers is arranged through the insulating layer 27 of proper thickness further again, and it is formed in abbreviation plate-like as a whole.
[0027] that in which thermal resistance is high and has required mechanical strength and workability as a raw material of said substrate 17 -- it is -- it is -- ****ing -- insulating materials and front faces, such as an alumina ceramic and glass, -- SiO2 etc. -- various things, such as a silicon substrate which carried out the clad with the insulating material, can be chosen.
[0028] As a raw material of said heat insulating layer 18, various things, such as high-melting glass with the small heat conductivity, foam glass, a zirconia ceramic, and a silicon dioxide, can be chosen.
[0029] As a raw material of said heater layer 19, various things, such as a tungsten, Nichrome, and tantalum nitride, can be chosen.
[0030] since big electric field are put to the ion added and generated as a raw material of said medium insulating layer 20 -- SiO2 with high insulation performance and stability, and A12 O3 etc. -- it is desirable to use the insulating material of an inorganic substance.
[0031] It is desirable to use metal raw materials, such as platinum, a tungsten, a tantalum, and

molybdenum, in consideration of conductivity and workability as a raw material of said individual electrode 21.
[0032] the ferroelectric which has the thermionic-emission operation which emits an electron with heating as a raw material of said electron emission section 22, for example, barium titanate, strontium titanate, zirconic acid barium, zirconic acid strontium, etc. can be illustrated, and independent [ if needed ] in these -- or it can combine and use.
[0033] As a raw material of said conductive layer 23, it has small electric conductivity and platinum high to thermal resistance, a tantalum, a tungsten, molybdenum, etc. are more desirable than the heater layer 19.
[0034] Various things, such as molybdenum and a tantalum, can be chosen as a raw material of said gate electrode 26.
[0035] since heat is added while big electric field are put to the ion added and generated as a raw material of said insulating layer 27 -- transparence with high insulation performance and stability with little heat loss or white SiO2, and A12 O3 etc. -- it is desirable to use the insulating material of an inorganic substance.
[0036] Moreover, as a fictitious outline shows to drawing 1 , the latent-image support 28 in which an electrostatic latent image is formed as the gate electrode 26 of said ion write head 16 is countered is arranged. While the proper dielectric layer 30 is formed in the front face of the desired metal base 29, this latent-image support 28 The fixed distance G of about 100 micrometers (gap) is separated from said gate electrode 26, it is arranged, and migration is made free with constant speed in the direction of vertical scanning which intersects perpendicularly to the main scanning direction where said each electron emission section 22 is arranged.
[0037] As shown in drawing 3 , the reference potential is formed when the actuation circuit 31 of the ion write head 16 of this example grounds the metal base 29 prepared in the opposite hand to the ion write head 16 of the latent-image support 28 as a back plate 32. While connecting electrically, let the power source VL for latent-image writing to which this actuation circuit 31 supplies the polar electrical potential difference of minus to the gate electrode 26 be a common electrode [ as opposed to the electrode 21 according to each in the gate electrode 26 ]. And each actuation transistor 33 makes the gate electrode 26 a reference potential, and the electrode 21 according to each is connected to the power source VE for electronic acceleration which impresses the polar electrical potential difference of minus to the gate electrode 26 through the current setting-out resistance 34 while connecting with the respectively proper actuation transistor 33. Moreover, the power source VH for heating is electrically connected to the heater layer 19 through the temperature control section which is not illustrated for always controlling the exoergic temperature of a heating unit 24 to fixed temperature. In addition, as for the energization of the power source VH for heating to the heater layer 19, it is desirable to control by the pulse voltage which synchronized with formation of the electrostatic latent image of each pixel based on a control command.
[0038] If said actuation circuit 31 is explained further, the actuation circuit 31 of this example will be constituted by the current regulator circuit, and the current of this current regulator circuit will be determined as the current setting-out resistance 34 connected to the emitter of each actuation transistor 33 with the electrical potential difference applied to the base of each actuation transistor 33. And the base electrical potential difference of each actuation transistor 33 is impressed by inputting the digital signal by which weighting was carried out through the D/A conversion circuit 35 which combined resistance with the ladder mold. Furthermore, the input signal over the ion write head 16 is made into the serial signal 36 in which each has another weight, and is changed into a parallel signal by the shift register 37 corresponding to each serial signal 36. Moreover, once this parallel signal is held at latch 38, it is outputted to a gate circuit 40 by the latch signal 39, takes ANDO with a strobe signal 41 by the gate circuit 40, and is inputted into the D/A conversion circuit 35. This strobe signal 41 is a signal which determines the operating time over the gate electrode 26 of the individual electrode 21.
[0039] That is, the electrode 21 according to each in this example is electrically connected to the actuation circuit which is insulated separately and has a constant current characteristic, and the heater

layer 19 has connected each heating unit 24 to a serial.
[0040] In addition, power is reducible by considering as the configuration which divides the heater layer 19 and is made into two or more groups.
[0041] Below, (j) explains the production process of the ion write head 1 of this example from (a) of drawing 4 .
[0042] First, sequential membrane formation of the heat insulating layer 18 which becomes the top face of the abbreviation plate-like proper substrate 17 which consists of insulating materials, such as glass, from a silicon dioxide, the heater layer 19 which consists of tantalum nitride, and the conductive layer 23 which consists of a tantalum is carried out using the well-known thin film formation approach. And etching etc. removes the position of the heater layer 19 and a conductive layer 23 in the same configuration, and as shown in (a) of drawing 4 , and (b), the heater layer 19 and a conductive layer 23 are formed in a predetermined configuration. Subsequently, as etching etc. removes the position of a conductive layer 23 and it is shown in (c) of drawing 4 , and (d), the predetermined part of the heater layer 19 is exposed and a predetermined number corresponding to the number of pixels of heating units 24 are formed. the next -- SiO2 from -- after forming the becoming medium insulating layer 20 similarly using the well-known thin film formation approach, as shown in (e) of drawing 4 , and (f), only the predetermined number corresponding to the number of pixels forms the individual electrode 21 which consists of metals, such as a tantalum, using the well-known thin film formation approach and well-known etching. the next -- SiO2 from -- as the becoming insulating layer 27 and the gate electrode 26 which consists of metals, such as a tantalum, are similarly shown in (g) of drawing 4 , and (h) after ****** one by one, etching etc. removes the position of the gate electrode 26 and the opening 25 of desired magnitude is formed. Subsequently, etching etc. removes the position of an insulating layer 27, and as shown in (i) of drawing 4 , the individual electrode 21 located under the opening 25 is exposed. By carrying out migration electrodeposition of the electrodeposted liquid which contains a ferroelectric on the individual electrode 21 next, and forming an electrodeposited film, the electron emission section 22 is formed and manufacture of the ion write head is completed. In addition, when forming the electron emission section 22, after forming the proper mold release layer (not shown) by the photoresist etc. on the gate electrode 26 at the process and forming the electron emission section 26 before forming the electron emission section 22, it is good to remove a mold release layer.
[0043] Below, it explains in more detail about formation of the electron emission section 22 of the ion write head 16 of this example.
[0044] In order to form the electron emission section 22 of this example, the electrodeposted liquid which uses a ferroelectric as a principal component is formed first. This electrodeposted liquid grinds the ferroelectric powder of perovskite molds, such as barium titanate, to particle-size extent of 1 micrometer or less with wet grinding, washes it with pure water, and removes impurities, such as a barium hydroxide. Next, 1% (wt%) of pure water as an electrolyte and 0.0012% (wt%) of calcium chlorides are added to a methanol, and the electrolytic solution is formed. Next, electrodeposted liquid is formed by adding the powder of a ferroelectric compound to said electrolytic solution 0.15%. PH of this electrodeposted liquid is a little less than seven, and conductivity is 30microS/cm extent. Although the ferroelectric compound itself is chemically stable and the solubility to water is small at this time, oxides, such as unreacted barium and titanium, react with water, turn into a hydroxide, and dissolve in water, and in order to reduce the resistivity of electrodeposted liquid, it is necessary to remove them beforehand. Moreover, in electrodeposted liquid, the calcium chloride in the electrolytic solution is ionized in calcium ion and a chloride ion, and is incorporated as a calcium hydroxide in the electrodeposited film formed. Subsequently, after stirring electrodeposted liquid, by putting for several hours, a ferroelectric compound with a large particle size is made to sediment, it removes, and manufacture of electrodeposted liquid is completed.
[0045] An electrodeposited film is formed on [ classified by each ] an electrode 21 by using the individual electrode 21 of the ion write head 16 as cathode, applying an about [ 50V ] electrical potential difference using the platinum which is hard to ionize to an anode plate, and next, performing migration electrodeposition. The current density at the time of this migration electrodeposition is 2 70mA/cm.

Extent and an electrodeposition rate are good to consider as 1 micrometer/min extent.
[0046] The electron emission section 22 is formed on [ classified by each ] an electrode 21 by performing heat treatment heated at about 200-300 degrees C in atmospheric air for several hours next, removing a methanol, and heating in atmospheric air or a vacuum at the temperature of about 600 degrees C after that for several hours. In addition, the calcium hydroxide incorporated in the electrodeposited film reacts with the carbon dioxide in atmospheric air by heat treatment, a part serves as a calcium carbonate, the remainder serves as a calcium oxide, and these lime compounds carry out the duty of cement which hardens between the fine particles of a ferroelectric (ferroelectric compound), and make firm the electrodeposited film used as the electron emission section 22 formed on [ classified by each ] the electrode 21.
[0047] Next, the ion write head 16 of this example was put into the vacuum tub, the electron emission section 22 was heated, and the amount of electron emission (emission) was evaluated. Whenever [ stoving temperature ] was gradually made high and the process which emission increases from a minute current field was recorded. The emission to each temperature is the same level as the thermionic-emission raw material of the oxide covering form of common barium or calcium, and has checked that a work function was almost equal. Moreover, when it was made to operate at the temperature for several hours, it has checked that the property was stable.
[0048] Subsequently, when the pressure of a vacuum tub was gradually made high toward the atmospheric pressure condition from the vacua and the property in the inside of atmospheric pressure was evaluated eventually, it became clear by enlarging the electric field between the individual electrode 21 and the gate electrode 26 that an electron could be efficiently emitted from the electron emission section 22. And the current which can be taken out from the electron emission section 22 was proportional to the electric field between the individual electrode 21 and the gate electrode 26, and while having a relation in inverse proportion to a distance in the meantime, it became clear that the current which can be taken out in atmospheric air was 1/100 to about 1/1000 as compared with the case in a vacuum.
[0049] Below, an operation of the ion write head 16 mentioned above is explained.
[0050] If the ion write head 16 of this example is made to drive and the current of the power source VH for heating is energized in the heater layer 19, the heating unit 24 formed in the heater layer 19 will generate heat, and generation of heat of this heating unit 24 will heat the individual electrode 21 and the electron emission section 22 to predetermined temperature. And the heated electron emission section 22 emits an electron (thermoelectron) to the space of the outside of the electron emission section 22 by the principle of thermionic emission.
[0051] The electron emitted to the space of the outside of said electron emission section 22 is caught by the oxygen molecule in the space between the gate electrode 26 and the latent-image support 28, after being accelerated by the electric field formed of the electrical potential difference of the power source VE for electronic acceleration impressed between the individual electrode 21 and the gate electrode 26, and it becomes oxygen ion, and the polar ion (not shown) of minus as a charged particle is generated. This ion moves toward the front face of the latent-image support 28 by the electric field which are impressed between the gate electrode 26 and the back plate 32 of the latent-image support 28, and are formed of the electrical potential difference of the power source VL for slack latent-image writing.
[0052] Moreover, the ion write head 16 of this example The electrode 21 according to each is formed in the shape of a single tier using a certain thin film formation approach, etching, etc. from the former. While being formed by making the upper part electrodeposit the electron emission section 22 and being able to form easily the electrode 21 according to each and the electron emission section 22 of complicated and detailed structure It can form in the shape of a line, and the resolution of the ion write head 16 can be raised easily.
[0053] Below, generation of ion and migration of ion are explained.
[0054] In this example, the gap G between the gate electrode 26 and the latent-image support 28 is set to 100 micrometers, potential of the gate electrode 26 is set to -500--600V to the back plate 32 of the latent-image support 28, and the electric field between the gate electrode 26 and the latent-image support

28 are carried out [ mm ] in 5-6kV /. The value of this electric field is a value of one half extent of the sparkover voltage in the atmospheric air in the gap G between the gate electrode 26 and the latent-image support 28.
[0055] Moreover, when an electron is made to emit into atmospheric air by heating the electron emission section 22 The mean free path of the oxygen molecule in about 400nm and atmospheric air of the mean free path of the electron in the inside of the air of atmospheric pressure is 64nm. The emitted electron is 103-104, while carrying out the drift of the between with a gap [ G ] of 100 micrometers. It collides with the gas molecule in time atmospheric air, it is caught by an oxygen molecule and the molecule of a steam probable, and the polar ion (O2-ion) of minus as a charged particle is generated. At this time, about by 2x10 to four, where ion and an electron are mixed, the probability for the electron of low energy to be caught by the oxygen molecule serves as an ionic current, arrives at the front face of the latent-image support 28, and it gives the polar charge of minus to the front face of the latent-image support 28, and the polar detailed electrostatic latent image of minus is formed in the front face of the latent-image support 28. That is, surface potential of the latent-image support 28 of an initial state (before an electrostatic latent image is written in) is set to 0V by electric discharge, and the electrostatic latent image of the potential which is proportional to the amount of attainment of the polar ion of minus of an electron on reception and its front face from the polar ion of the minus which arrived at the front face of the latent-image support 28 is formed. Since the ion and electron which arrive at the front face of the latent-image support 28 at this time move to line of electric force at parallel, that breadth can be disregarded until electrostatic latent-image potential is saturated. The maximum of the potential of this electrostatic latent image is saturated with the value near the electrical potential difference of the power source VL for latent-image writing.
[0056] Therefore, the polar ion of the minus which arrived at the front face of the latent-image support 28 after the potential of an electrostatic latent image was saturated moves to the one where latent-image potential is smaller along the front face of the latent-image support 28, and gives a charge to the front face of the part. That is, the electrostatic latent image on the latent-image support 28 will spread in concentric circular. The breadth of this electrostatic latent image decreases, so that the gap G between the gate electrode 26 and the latent-image support 28 is short.
[0057] The mass of said ion is 5.9x104 of an electron. It is about twice, and passing speed of the ion by the electric field between said gate electrodes 26 and back plates 32 of the latent-image support 28 is made into 100 m/S extent, and the transit time of the ion between said gaps G of 100 micrometers becomes about [ 1micro ] S.
[0058] Here, the time amount which the magnitude of one pixel (dot) will be about 84.67-micrometer angle, and the writing of one line will take the resolution of image formation if passing speed (process rate) of 300DPI and the latent-image support 28 is made into 100 mm/S is set to 847microS, and since the passing speed of ion is fully shorter than the write time of one line, it does not become the failure of the writing of an electrostatic latent image.
[0059] Moreover, when there is little emission from the electron emission section 22, the ionic current which the electrical potential difference of the gate electrode 26 is subtracted to the potential of the electron emission section 22, and the potential of the part near the opening 25 of the space around the electron emission section 22 is subtracted, and becomes from ion and an electron is converged on the core of the opening 25 of the gate electrode 26. The convergence rate of the ionic current to the opening 25 of this gate electrode 26 becomes about 3 times at the maximum.
[0060] that is, the amount of the ion which concentrates the magnitude of the electrostatic latent image formed on the latent-image support 28 on the small diameter which line of electric force reaches when there are few amounts of the polar ion of the minus which arrives at the front face of the latent-image support 28, and reaches -- increasing -- ** -- the polar potential of minus of the electrostatic latent image which is not rises, and the line of electric force which arrives at the front face of the latent-image support 28 spreads. The area of a breadth electrostatic latent image will be expanded to concentric circular by the polar ion of the minus which takes and reaches it on the front face of the latent-image support 28.
[0061] Therefore, linearity of the area of the electrostatic latent image over the amount of the generated

ion can be made very high.
[0062] [ when developing an electrostatic latent image with a toner and considering as a toner image ] namely, the linearity of the coating weight of a toner By the case where the area of the electrostatic latent image of the case where the potential of an electrostatic latent image has halftone, and fixed potential changes Since area gradation can form the electrostatic latent image of a detailed area also in a low printing concentration field and printing by wide range area gradation is attained, the ion write head 16 of this example The high-definition quality of printed character in which the repeatability of gradation was extremely excellent compared with the conventional ion write heads 1 and 1a can be obtained. This quality of printed character is excellent also to the quality of printed character of an electrophotography method which has the high resolution used for the application as which high resolution, such as printing of an alphabetic character, is required.
[0063] Amplification of the area of said electrostatic latent image does not necessarily break out indefinitely, and is restricted to the fixed range according to the amount of the ion which reaches by the electric field impressed between the gate electrode 26 and the back plate 32 of the latent-image support 28. Moreover, the potential of the electrostatic latent image formed is also restricted to the almost fixed value near the electrical potential difference impressed between the gate electrode 26 and the back plate 32 of the latent-image support 28.
[0064] Although the gap G between said gate electrodes 26 and latent-image support 28 is restricted by the precision of the gap G between the gate electrode 26 at the time of making it run the danger and the latent-image support 28 of the short circuit by trespass of a toner, and the latent-image support 28, as for the gap G between the gate electrode 26 and the latent-image support 28, it is desirable to constitute so that the distance G of abbreviation regularity may always be held.
[0065] In addition, since it collides with the front face of the gate electrode 26 with which the polar ion of the plus which exists in atmospheric air is formed in the front face of the ion write head 16 of the electric field between the gate electrode 26 and the latent-image support 28, and potential is [ area ] large subtracted most, the probability which carries out the spatter of the electron emission section 22, and is exhausted is very small, and the electron emission section 22 can hold the function continued and stabilized at the long period of time.
[0066] Moreover, since the rate which ion moves is proportional to the magnitude of electric field, it is desirable to consider as high electric field within limits which do not carry out dielectric breakdown.
[0067] Below, a current required for electrostatic latent-image formation is explained.
[0068] The potential of the electrostatic latent image formed in the front face of said latent-image support 28 is decided by the ratio of the electrostatic capacity of the dielectric layer 30 of the ion or electronic charge which reaches the latent-image support 28, and the latent-image support 28. Here, when thickness of the dielectric layer 30 of the latent-image support 28 is set to 20 micrometers and the dielectric constant is set to 2.5, it is 2 1cm. The electrostatic capacity of a hit is set to 110.7pF. The charges taken to electrify the dielectric layer 30 of this latent-image support 28 from OV to -500V are 55.35nC(s). When width of face of the image recording of the latent-image support 28 is made to 210mm and a process rate is made into 100 mm/s, a current required of the ion write head 16 whole is 11.62microA. The number of pixels at the time of setting the die length of the printing section to 210mm becomes 2480 pieces in 300DPI, becomes 3307 pieces in 400DPI, and the average current per electrode 21 according to each serves as 4.69nA(s) in 300DPI, and it serves as 3.51nA(s) in 400DPI.
[0069] When magnitude of said individual electrode 21 is made into the diameter of 30 micrometers, the area is 7.07x10 to 6 cm2. Current density is 497microA/cm2 in 663microA/cm2 and 400DPI at 300DPI. It becomes. And 100 mA/cm2 in the case of operating the individual electrode 21 in a vacuum in respect of current density Although it is quite small, it is equivalent level when it takes that ion or electrons are scattered about in atmospheric air, and mobility falls into consideration. The magnitude of this individual electrode 21 is restricted by current density and the dimensional accuracy by the processing technique.
[0070] Below, the tone reproduction at the time of using a liquid phenomenon is explained.
[0071] As for the tone reproduction at the time of using a liquid phenomenon, the resolution of the ion

write head 16 serves as a determinant. The diameter of 30 micrometers and the gate electrode 26 is set to 20 micrometers for the diameter of the individual electrode 21, the minimum of the magnitude of an electrostatic latent image is set to 7 micrometers, the upper limit of the magnitude of an electrostatic latent image serves as 84.67-micrometer angle in 300DPI, and the ion write head 16 in this example serves as 63.5-micrometer angle in 400DPI. And dot area in case the diameter of an electrostatic latent image is 7 micrometers is 2 38.5 micrometers. Becoming, an area of 1 pixel of each resolution is 2 4032 micrometers in 2 and 400DPI 7069 micrometers at 300DPI. It becomes, and it can become 183.6 times in 300DPI, it can become 104.7 times in 400DPI, and surface ratio can be made without a dither into outline 128 gradation (7 bits) extent. Furthermore, each color 256 gradation (8 bits) 1,670,000 color specification is possible by the dither of a 2-4-pixel unit.

[0072] Below, the tone reproduction of a using-dry developing case is explained.

[0073] As for the tone reproduction at the time of using dry developing, the particle size of a toner serves as a determinant. Whenever [ by the current grinding method / high image ], a typical particle size of a toner is about 7 micrometers, and the minimum of the magnitude of an electrostatic latent image is set to about 14 micrometers. The dot area in this case is 2 153.9 micrometers. The surface ratio of an electrostatic latent image becomes 45.9 times in 300DPI, and becomes 26.2 times in 400DPI, and processing of a dither becomes unnecessary when the printing concentration of each pixel is larger than the minimum value determined by the above-mentioned surface ratio, since the linearity of the magnitude of an electrostatic latent image is high. Moreover, when printing concentration is smaller than the minimum value of the above-mentioned surface ratio, in order to obtain a gradation rendering with a color [ each ] of 8 bits, it is good to use the dither of 9 dots of 3x3, and the matrix of the 16-dot unit of 4x4.

[0074] Below, the resolution in ion writing is explained.

[0075] According to the printer using the ion write head 16 of this example, it can reappear without 8-bit (256 gradation's) a total of 1,670,000 colors' almost using a dither for three primary colors respectively, and resolution of an image can be made into the level near a photograph or a sublimation mold.

[0076] In the case of the image of the bit map of a color, there will be few pixels of a great portion of data because of a limit of amount of information than the number of pixels of the image constituted by the ion write head 16, and it will expand with software, and will print. As the typical number of pixels, 640 dots wide, the length of 480 dots, and the amount of information of 24 bits (1,670,000 colors) become 900 K bytes, when not compressing data. The resolution in the case of printing the image in 8cm wide and 6cm long magnitude is set to mm in 8 dots (about 200 DPI) /. It is possible to acquire the 300 - 400DPI ****** as the usual page printer with the same resolution and repeatability faithful except when printing an image with high resolution specially.

[0077] Moreover, according to the printer using the ion write head 16 of this example, although overwhelmingly excelled to the electrophotography method etc. in the repeatability of concentration gradation, in printing of an alphabetic character without gradation, the resolution of a print head becomes the factor which determines image quality. Although the resolution of the direction (main scanning direction) where the pixel of the line head as a print head is located in a line is decided by resolution of a print head The number of the individual electrodes 21 used as the number of the pixels in the ion write head 16 of this example It is easy to make it subdivide to the direction (the direction of vertical scanning) to which the latent-image support 28 or a printing medium moves (increment). In printing of an alphabetic character, the notch of the edge of the printed alphabetic character can be made smooth by making the number of the individual electrodes 21 in the ion write head 16 increase, and making resolution high.

[0078] Therefore, while the ion write head 16 of this example can make electrostatic latent-image formation generate the ion of only a complement on real time unlike the conventional ion write heads 1 and 1a by the corona discharge and high frequency discharge using high tension, integration of the actuation circuit 31 becomes easy, and while the price can miniaturize and fall certainly, resolution can be raised certainly.

[0079] Drawing 8 shows the 2nd example of the ion write head concerning this invention from drawing

5 , drawing 5 is drawing of longitudinal section showing the configuration of an important section, drawing 6 is a gate electrode and the top view which excluded the insulating layer, drawing 7 is the sectional side elevation of drawing 6 , and drawing 8 is the circuit diagram showing an actuation circuit.
[0080] Ion write head 16a of this example is taken as the configuration which carried out grouping of the individual electrode 21 while the individual electrode 21 of said 1st example serves as the function of the heater layer 19.
[0081] As shown in drawing 5 , the heating individual electrode layer 42 of the predetermined configuration for making the heater layer 19 and the individual electrode 21 of the 1st example which the heat insulating layer 18 is arranged on the substrate 17, and mentioned above ion write head 16a of this example in the top face of this heat insulating layer 18 serve a double purpose is arranged. And the conductive layer 23 is arranged in the top face of the heating individual electrode layer 42. Furthermore, the heating individual electrode layer 42 and the conductive layer 23 are etched into the same predetermined configuration. Moreover, the position of the conductive layer 23 on the heating individual electrode layer 42 is removed by etching etc., and, thereby, the heating unit 24 on which generation of heat of the heating individual electrode layer 42 is centralized to the electron emission section 22, and individual electrode 21a called the cathode electrode corresponding to resolution (pixel number) are formed. This individual electrode 21a is made into magnitude with a diameter of about 30 micrometers, and as shown in drawing 5 and drawing 6 , alignment arrangement is carried out at the longitudinal direction (the print width direction) at the shape of a single tier. And the electron emission section 22 which may emit the electron for generating a charged particle (ion) is arranged in the top face of electrode 21according to each a. Moreover, on the heat insulating layer 18, it centered on each electron emission section 22, for example, the gate electrode 26 which has the circular opening 25 with a diameter of about 20 micrometers is arranged through the insulating layer 27 of proper thickness, and it is formed in abbreviation plate-like as a whole.
[0082] As a raw material of said heating individual electrode layer 42, platinum, a tantalum, molybdenum, a tungsten, etc. are suitable.
[0083] That is, in ion write head 16a of this example, while the part which is not covered with the conductive layer 23 of the heating individual electrode layer 42 is set to individual electrode 21a, it is set to heating unit 24a for heating each electron emission section 22, and it has the composition that the electron emission section 22 is directly formed on individual electrode 21a. Moreover, as shown in drawing 6 , grouping of the heating individual electrode layer 42 in this example is carried out so that four individual electrode 21a may become 1 set. It is not especially limited to the number of individual electrode 21a of this example that what is necessary is for resolution, a design concept, etc. of ion write head 16a just to determine the number of individual electrode 21a in this 1 group.
[0084] As shown in drawing 8 , actuation circuit 31of ion write head 16a of this example a is constituted so that time sharing of the electrode 21according to each a may be carried out and it may be heated, and the power source VH for heating is connected to electrode 21according to each a through the DC/DC conversion circuit 43 of an insulating mold, and the heater change-over circuit 44 as a switch for the on/off of every electrode 21according to each a. And the heater change-over signal 46 which carries out on/off of the heater change-over circuit 44 through the photo coupler 45 corresponding to electrode 21according to each a is inputted into the heater change-over circuit 44. Other configurations are the same as that of the actuation circuit 31 of the 1st example mentioned above.
[0085] By considering as such a configuration, this example By considering as the configuration which forms the electronic radiator 22 directly on individual electrode 21a which served as the heating unit 24, while doing so the same effectiveness as the 1st example mentioned above While a production process can be simplified, being able to reduce the number of production processes and being able to reduce an economic burden certainly Since a miniaturization can be attained and (the amount of accumulation) can be made small for heat capacity, the responsibility over a temperature change can be raised and heating time for the electron emission section 22 to emit an electron can be shortened. Moreover, since the medium insulating layer 20 in the 1st example can be excluded, there is no temperature gradient and the utilization effectiveness of heat can be raised certainly.

[0086] Drawing 11 is the top view showing the configuration of the important section which excluded the gate electrode and the insulating layer, drawing 13 shows the 3rd example of the ion write head concerning this invention from drawing 9 , drawing 9 is drawing of longitudinal section showing the configuration of an important section, drawing 10 is the top view of drawing 9 , and drawing 13 is [ drawing 12 is the sectional side elevation of drawing 11 , and ] the circuit diagram showing an actuation circuit.
[0087] Ion write head 16b of this example is taken as the configuration which divided the gate electrode 26 so that it might correspond to electrode 21according to each a of said 2nd example.
[0088] Gate electrode 26a divided by the insulating layer 27 is arranged, and as shown in drawing 12 from drawing 9 , ion write head 16b of this example is formed so that the configuration of the heating individual electrode layer 42 may also correspond to gate electrode 26a, so that it may correspond to electrode 21according to each a formed in the heating individual electrode layer 42. Other configurations are the same as that of ion write head 16a of the 2nd example mentioned above.
[0089] As shown in drawing 13 , while time sharing of the actuation circuit 31of ion write head 16b of this example b is carried out and it heats each gate electrode 26a, it is constituted so that electrode 21according to each a may be heated for every group, and the power source VL for latent-image writing is connected to each date electrode 26a through the gate change-over circuit 47 as a switch for the on/off of each gate electrode 26a of every. He is trying for this gate change-over circuit 47 to operate with the gate change-over signal 48. Moreover, the power source VH for heating is connected to individual electrode 21a by which grouping was carried out per four pieces through the DC/DC conversion circuit 43 of an insulating mold. Other configurations are the same as that of actuation circuit 31a of the 2nd example mentioned above.
[0090] This example can do so the same effectiveness as the 2nd example mentioned above by considering as such a configuration.
[0091] Below, drawing 18 explains the structure of holding uniformly the distance G of the gate electrode 26A (a sign names generically the gate electrodes 26 and 26a) and the latent-image support 28 of each ion write head 16A (a sign names generically the ion write heads 16, 16a, and 16b) of this example, from drawing 14 .
[0092] Drawing 14 shows the 1st example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0093] This example uses for a front face the dielectric drum 49 which has a dielectric layer 30 as latent-image support 28.
[0094] In this example, the proper contact rollers 50 and 50 are arranged in the both ends of the longitudinal direction which is the print width direction of ion write head 16A, and the dielectric drum 49 is arranged through these contact rollers 50 and 50. And they are contacted with the front face of the dielectric drum 49 while they are arranged free [ a revolution ], as each contact rollers 50 and 50 avoid the printing area of the front face of the dielectric drum 49. furthermore, the proper pressurization contacted with the support frame which ion write head 16A is supported free [ migration in the direction of the normal of the front face of the dielectric drum 49 ], and was arranged in the tooth back of ion write head 16A, and which is not illustrated -- it enables it to hold a predetermined distance (spacing) to the front face of the dielectric drum 49 with the thrust of a spring 51 In addition, contact pressure of each contact roller 50 may be made small, and the printing area of the dielectric drum 49 may be made to contact.
[0095] Drawing 15 shows the 2nd example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0096] In this example, like the 1st example shown in drawing 14 , the contact roller 50 is not arranged in ion write head 16A, but the desired blade 52 as a cleaning means which makes the dielectric drum 49 at clarification the lower part of ion write head 16A is arranged instead. And the proper waste toner receptacle 53 is arranged at the lower part of a blade 52. Moreover, he is trying to touch the dielectric drum 49 with the record media 55, such as a form, in imprint / fixation section 54 caudad shown in drawing 15 .

[0097] By such configuration as well as the 1st example which is shown in drawing 14 and which was mentioned above, the distance of the gate electrode 27A and the latent-image support 28 of ion write head 16A can be held uniformly.
[0098] Drawing 16 shows the 3rd example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support, (a) is a perspective view and (b) is drawing of longitudinal section.
[0099] The dielectric belt 56 of the shape of an endless belt which has flexibility as latent-image support 28 is used for this example.
[0100] The proper belt attachment component 57 is arranged in ion write head 16A, the dielectric belt 56 is positioned to ion write head 16A, and the distance of gate electrode 26A which ion write head 16A does not illustrate, and the front face of the dielectric belt 56 is made to ** uniformly in this example. In this case, it is important to set thickness of the dielectric belt 56 constant.
[0101] Since the location of ion write head 16A is easily fixable as compared with the configuration using the dielectric drum 49 shown in drawing 14 and drawing 15 according to such a configuration, it is advantageous when holding uniformly the distance of the gate electrode 27A and the latent-image support 28 of ion write head 16A.
[0102] Drawing 17 shows the 4th example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0103] This example uses the dielectric belt 56 as latent-image support 28 like the 3rd example shown in drawing 16 .
[0104] It pushes against the belt attachment component 57a side which arranged the front face of the dielectric belt 56 so that the front face of ion write head 16A might be covered, and distance is made to hold uniformly in this example. And it forms in belt attachment component 57a of this example by the insulating layer 59 which consists of a proper insulator so that the electrostatic latent image formed in the front face of the dielectric belt 56 in the downstream front face 58 of ion write head 16A may not be disturbed. In addition, while making the downstream front face 58 of ion write head 16A not contact the front face of the dielectric belt 56, the conductive layer 61 which becomes the inlet face 60 of ion write head 16A from a conductive ingredient is formed, and it may be made to discharge the dielectric belt 56.

[0105] Drawing 18 shows the 5th example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0106] This example makes the structure of the 4th example shown in drawing 17 inject a fluid (air) toward the dielectric belt 56 from the front face of ion write head 16A, and it is made to surface the dielectric belt 56 in fixed height from the front face of ion write head 16A.
[0107] In this example, it prepares in each [ the proper orifice 63 for maintaining the balance of the flow rate of the air which flows each nozzle 62 while forming two or more nozzles 62 is connected / each / front face / of head attachment component 55a / at each nozzle 62 ] passage 64, and supply of application-of-pressure air is enabled to each passage 64. In addition, the flying height to ion write head 16A of the dielectric belt 56 is good to be referred to as about 50 micrometers.
[0108] According to such a configuration, the dielectric belt 56 is not influenced of the conductive existence of the front face of ion write head 16A in order not to contact ion write head 16A. Moreover, since the toner which adheres to the front face of the dielectric belt 56 with the pressure of air and which is not illustrated can be eliminated outside, the inconvenience that a toner adheres to the electron emission section can also be prevented certainly.
[0109] Below, drawing 21 explains the printer which used ion write head 16A of this example from drawing 19 .
[0110] Drawing 19 shows the 1st example of the printer concerning this invention.
[0111] The dielectric drum 49 is used for the printer 65 of this example as latent-image support 28.
[0112] As shown in drawing 19 , the printer 65 of this example The dielectric drum 49 is arranged free [ a revolution ] by the clockwise rotation shown by the arrow head in drawing 19 . Ion write head 16A as latent-image means forming which forms in the perimeter of this dielectric drum 49 clockwise the

electrostatic latent image corresponding to the image of the request which is not illustrated on the dielectric drum 49 from the upper part in drawing 19 , The proper development counter 66 as a development means to develop with the toner which does not illustrate an electrostatic latent image, The application-of-pressure roller 67 as an imprint fixation means by which it is established while imprinting the electrostatic latent image which the toner developed on the record media 55, such as a form, The cleaner 69 which has the proper metal blade 68 as a cleaning means which makes the dielectric drum 49 clarification, and proper AC electric discharge machine 70 as an electric discharge means to remove the electrification condition of the dielectric drum 49 are arranged in order, and are formed.

[0113] The toner (not shown) of the same plus electrification as the normal development using the photo conductor of minus electrification is used for said development counter 66, and it is used especially for the sleeve 71 of a development counter 66 with touch-down potential, without applying bias voltage.

[0114] Moreover, an imprint and fixation make the contact force of a request of the application-of-pressure roller 67 have and contact the dielectric drum 49, and push a record medium 55 against the dielectric drum 49, and the pressure of said contact pressure performs them simultaneously. While fixation becomes possible by this, without using a heat fixing assembly and decreasing power consumption, warm-up time can be made unnecessary.

[0115] Moreover, although the blade (not shown) of the cleaner used for the conventional electrophotography is made into the product made of rubber since a photo conductor (not shown) tends to get damaged, since the blade 68 of the cleaner 69 of the printer 65 of this example has the high reinforcement of the dielectric drum 49, a metal thing can be used for it, and it can raise the precision of a blade 68, and endurance certainly. And for electric discharge of the dielectric drum 49, AC electric discharge machine 70 can neutralize the charge of the front face of the dielectric drum 49 efficiently using the ion of the amphipathy of plus and minus.

[0116] According to the printer 65 of this example which consists of such a configuration, while being able to obtain a high-definition quality of printed character with the conjointly very high repeatability of gradation with the effectiveness of ion write head 16A mentioned above, it can use for various applications.

[0117] Drawing 20 shows the 2nd example of the printer using the head concerning this invention.

[0118] The dielectric belt 56 is used for printer 65a of this example as latent-image support 28.

[0119] as shown in drawing 20 , while being supported free [ a revolution ] in printer 65a of this example -- up and down -- alienation -- two rollers 72 and 73 made into the condition are arranged, either of the rollers 72 and 73 is used as a drive roll, and another side is considered as the follower roll. And as the peripheral face of each roller 72 and 73 is contacted, the dielectric belt 56 is wound. Furthermore, transit of the dielectric belt 56 in the direction shown by the arrow head in drawing 20 with said each rollers 72 and 73 is enabled.

[0120] Ion write head 16A as latent-image means forming which forms in the method of the lower left of said dielectric belt 56 the electrostatic latent image corresponding to the image of the request which is not illustrated is arranged. And the proper development counter 66 as a development means to develop to the method of the lower right of the dielectric belt 56 with the toner which does not illustrate an electrostatic latent image is arranged. Furthermore, the proper cleaner 69 as a cleaning means which carries out clarification of the dielectric belt 56 is arranged at the up left of the dielectric belt 56. Moreover, between ion write head 16A and a cleaner 69, proper AC electric discharge machine 70 as an electric discharge means to remove the electrification condition of the front face of the dielectric belt 56 as it counters with the dielectric belt 56 is arranged.

[0121] The ion generator 74 as electrostatic image transfer which imprints the electrostatic latent image which the horizontal left shown by the arrow head in drawing 20 developed with the toner through the record medium 55 whose transit was enabled on a record medium is arranged in the upper part of said dielectric belt 56. This ion generator 74 is made into the structure of having the same electron emission section 22 as ion write head 16A.

[0122] Moreover, the fixing roller 75 as a fixation means to fix a toner to a record medium 55 according to an operation of heat, and the application-of-pressure roller 76 which has elasticity enable pinching of

a record medium 55, and is arranged at the transit direction downstream of a record medium 55.
[0123] According to printer 65a of this example which consists of such a configuration, the same effectiveness as the printer 65 of the 1st example mentioned above is done so. And the structure of the ion generator 74 used for the electrostatic image transfer of this example does not have the need for image formation, and since there are also few homogeneous demands of a current, the number of the electron emission sections 22 can be reduced, or it can enlarge distance between the ion generator 74 and the dielectric belt 56. Furthermore, since the toner to a record medium 55 is established with a fixing roller 75 and the application-of-pressure roller 76, generating of the gloss of the record medium 55 by crushing the record medium 55 and toner at the time of using the application-of-pressure roller 67 of the printer 65 of the 1st example mentioned above by the high pressure and a toner can be prevented certainly, and a more nearly high-definition quality of printed character can be obtained. Moreover, since the ion generator 74 has the high consistency of the generated ion compared with the generating means of other ion, such as corotron which is not illustrated, an imprint field is limited, and the ion generator 74 can prevent degradation of the image by imprint certainly while miniaturizing like ion write head 16A and being able to operate it with a low battery and a low power. Furthermore, the ion generator 74 is the same polarity as ion write head 16A, and since it can be made to operate with few currents, the power source of the actuation circuit which ion write head 16A does not illustrate can be shared. This can decrease an economic burden certainly while being able to attain certainly the miniaturization of the actuation circuit of the whole printer 65a, equipment (not shown), etc.
[0124] Drawing 21 shows other examples of the printer which used the dielectric belt as latent-image support.
[0125] The ion generator 74 as electrostatic image transfer which imprints the electrostatic latent image which the toner developed like printer 65a of the 2nd example mentioned above in printer 65b of this example on a record medium 55 is not arranged. As an imprint fixation means fixed while imprinting a toner to a record medium 55 instead, as a fixing roller 75 and the application-of-pressure roller 76 pinch dielectric belt 56a formed with heat-resistant raw materials, such as polyimide, they are arranged. This fixing roller 75 caudad Two rollers 72 and 73 are arranged at parallel at right and left, and as said dielectric belt 56a contacts each peripheral face of said fixing roller 75 and two rollers 72 and 73, it is wound around it.
[0126] Ion write head 16A as latent-image means forming which forms in the lower part of said dielectric belt 56a the electrostatic latent image corresponding to the image of the request which is not illustrated is arranged, and the proper development counter 66 as a development means to develop to the method of the lower right of dielectric belt 56a with the toner which does not illustrate said electrostatic latent image is arranged. Furthermore, the proper cleaner 69 as a cleaning means which makes dielectric belt 56a clarification is arranged at the method of the lower left of dielectric belt 56a, and proper AC electric discharge machine 70 as an electric discharge means to remove the electrification condition of dielectric belt 56a as the upper part is countered with dielectric belt 56a is arranged.
[0127] While doing so the same effectiveness as printer 65a of the 2nd example mentioned above according to printer 65b of this example which consists of such a configuration, **** of the image at the time of an imprint can be prevented more certainly, and a more nearly high-definition quality of printed character can be obtained, and a miniaturization can be attained easily. In addition, the heater element of a single dimension like a thermal head or a 2-dimensional heating element can also be used instead of a fixing roller 75.
[0128] Moreover, this invention is not limited to said each example, and the combination of said each ion write heads 16, 16a, and 16b, said individual electrodes 21 and 21a, and each of said actuation circuits 31, 31a, and 31b can be chosen from the thing of various kinds of combination that what is necessary is for a design concept just to determine.
[0129] This invention is not limited to said each example, and can be changed further again if needed.
[0130]
[Effect of the Invention] Thus, according to the ion write head of this invention, since ion is generated by the principle of thermionic emission, ion can be generated in low energy. Moreover, in order not to

use corona discharge for generating of ion, there is no generating of ozone. Moreover, since the magnitude of the ionic current which contributes to writing is controllable only by controlling the electric field applied between a gate electrode, an individual electrode and an individual electrode, and latent-image support, the magnitude of the toner image formed is changed to many stairways, and the extremely excellent effectiveness, like a multi-tone print can be performed easily is done so.

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[Translation done.]

* NOTICES *



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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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TECHNICAL FIELD

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[Industrial Application] This invention relates to the suitable ion write head for the electrostatic recording equipment which the charged particle corresponding to an image is made to adhere selectively from the exterior, and forms an electrostatic latent image on the latent-image support constituted with a dielectric.

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[Translation done.]

* NOTICES *



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PRIOR ART

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[Description of the Prior Art] While the mechanical reinforcement of latent-image support is high in recent years as compared with the photo conductor used as latent-image support in the conventional electrophotography method and using the latent-image support formed with the dielectric which is excellent also in the stability over temperature or a repeat At high speed, the printer of the ion write-in formula which forms an electrostatic latent image using a charged particle (ion) instead of the conventional light has dramatically much printing number of sheets, and is used abundantly at few [ the frequency of a maintenance ] business-use high-speed printers etc. And since control of latent-image potential is easy as compared with the printer of the electrophotography method which used the photo conductor, by controlling the coating weight of developers, such as a toner, the printer of an ion write-in formula is suitable for printing which has concentration gradation, and suitable for the full color printer than to which greater importance is attached to the repeatability of concentration gradation.
[0003] Hereafter, such the conventional ion write head is explained.
[0004] Drawing 22 shows an example of the conventional ion write head, (a) is the perspective view showing the whole configuration, and (c) is [ (b) is drawing of longitudinal section showing the configuration of an important section, and ] the explanatory view showing the arrangement condition of a line electrode and a finger electrode.
[0005] As shown in (a) of drawing 22 , the screen electrode 2 is formed on the surface of one side, two or more openings 3 are arranged and formed in the front face serrate, and the conventional ion write head 1a is made abbreviation plate-like as a whole. And as shown in (b) of drawing 22 , the screen electrode 2, the finger electrode 4 with opening 3, and the line electrode 5 are arranged through the insulating layer 6 which consists of a desired dielectric, respectively. Moreover, as shown in (c) of drawing 22 , the opening 3 of the finger electrode 4 and the line electrode 5 are arranged in the shape of a matrix. And as shown in (b) of drawing 22 , each opening 3 is arranged in it as ion write head 1a counters the latent-image support 7.
[0006] In such conventional ion write head 1a, by the actuation circuit of the request which is not illustrated between the finger electrode 4 and the line electrode 5, the frequency of 1MHz and about [ electrical-potential-difference 1kV ] high-frequency voltage are impressed, and the ion 8 ((b) of drawing 22 ) as a charged particle by discharge is generated in the atmospheric air of the circumference of the finger electrode 4. Moreover, as shown in (c) of drawing 22 , two or more line electrodes 5 are formed, and high-frequency voltage is impressed to one of them one by one. And the direct current voltage of -600V is impressed to the screen electrode 2, and the electrical potential difference of -400V is impressed to the finger electrode 4 at the time of -700V and printing at the time of standby. Furthermore, pulse width at the time of printing is made about [ 20micro ] into S, and for example, it generated in the atmospheric air of the circumference of the finger electrode 4, the polar ion 8 of minus is controlled by the screen electrode 2, and it is made to collide with the latent-image support 7 through opening 3, as shown in (b) of drawing 22 .
[0007] Said latent-image support 7 is used as the so-called dielectric drum 11 on which the desired dielectric layer 10 was formed in the front face of the metal drum 9 as shown in (b) of drawing 22 , and

said metal drum 9 is grounded. And as mentioned above, the electrostatic latent image corresponding to the image of the request which is not illustrated is formed in the front face of the dielectric drum 11 by making the polar ion 8 of minus as a charged particle collide with the front face of the dielectric drum 11.

[0008] The conventional ion write head 1b of other examples is shown, in this conventional ion write head 1b, corotron 12 is used for generating of the ion 8 as a charged particle, the control electrodes 14 and 14 of two sheets which have two or more desired openings 13 in that front face are arranged, and drawing 23 is driven by the proper actuation circuit 15. And it is controlled whether the ion 8 8 generated in corotron 12, for example, the ion of a plus polarity, makes it reach from opening 13 to the latent-image support 7 with the polarity of the electrical potential difference applied among the control electrodes 14 and 14 of two sheets. Moreover, distance between the control electrodes 14 and 14 of two sheets is set to about 100 micrometers, and the diameter of opening 13 is set to about 200 micrometers. Furthermore, resolution of ion write head 1b is carried out in about 8 dots/mm. Moreover, said opening 13 is arranged by serrate like the opening 3 of head 1a shown in (a) of drawing 22 mentioned above.

[0009]

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Thus, according to the ion write head of this invention, since ion is generated by the principle of thermionic emission, ion can be generated in low energy. Moreover, in order not to use corona discharge for generating of ion, there is no generating of ozone. Moreover, since the magnitude of the ionic current which contributes to writing is controllable only by controlling the electric field applied between a gate electrode, an individual electrode and an individual electrode, and latent-image support, the magnitude of the toner image formed is changed to many stairways, and the extremely excellent effectiveness, like a multi-tone print can be performed easily is done so.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, in the conventional ion write head 1 (a sign names generically the conventional ion write heads 1a and 1b) mentioned above, since it is impossible to make latent-image formation generate the ion 8 of only a complement on real time, a lot of ion 8 is always generated, the part is drawn on the latent-image support 7 by the screen electrode 2 or the control electrode 14 of two sheets, and 14 grades, and an electrostatic latent image is formed. For this reason, the utilization effectiveness of the generated ion 8 was low, and there were various troubles of processing of the ozone generated simultaneously with ion 8, buildup of power consumption, enlargement of a head 1, enlargement, formation of an expensive rank of the actuation circuit 15 for control electrodes that controls high tension, etc.
[0010] Moreover, in the conventional ion write head 1, there was a trouble that the minimum of the magnitude of the openings 3 and 13 which ion 8 passes had constraint. One of the constraint of this is for enlarging utilization effectiveness of the generated ion 8, I hear that another must make the process tolerance and isolation voltage of the screen electrode 2 which impresses high tension, or a control electrode 14 hold, and there is.
[0011] That is, the trouble of using the screen electrode 2 or control electrode 14 which has the big openings 3 and 13 is a point that the diameter of 1 dot of the electrostatic latent image formed when the point that the absolute value of control voltage becomes large, and the ion 8 (ionic current) which flows toward the latent-image support 7 from the ion write head 1 are extracted does not become small enough. In extracting an ionic current, the diameter of an ionic current converges on about [ of the diameter of the openings 3 and 13 of control electrodes 2 and 14 / 1/several ] for the electrical potential difference which joins electrodes 2 and 14. For this reason, the diameter of 1 dot of the electrostatic latent image formed becomes small compared with an increase or the case where it carries out, about an ionic current. However, the potential of the electrostatic latent image at the time of extracting an ionic current for the limitation of the rate of focusing serves as an in-between value, and will reproduce halftone with potential.
[0012] Moreover, although the repeatability in the case of area gradation is good when reproducing concentration gradation with the coating weight of a toner, the repeatability in the case of concentration gradation does not have so good repeatability by factors, such as dispersion in the amount of electrifications of a toner. Generally, it is said that the conventional ion write head 1 is excellent in the repeatability of concentration gradation compared with other write-in methods. Although the repeatability and stability of gradation in case many flow rates of ion 8 go into the field of area gradation are excellent if it sees strictly about this repeatability, the tone reproduction at the time of extracting the flow rate of ion 8 is inferior compared with the high concentration field. And when not changing but reproducing gradation by change of potential, there cannot but be many factors which degrade the grace of images, such as dispersion in the coating weight of a toner, at a development process, and the area of an electrostatic latent image cannot but become what was inferior to the tone reproduction in area gradation as a result, even if formation of an electrostatic latent image is performed to accuracy to an input signal.

[0013] That magnitude of said openings 3 and 13 cannot be made small has the trouble of the constraint on the design of not comparing openings 3 and 13 with the ability of resolution not being raised on a straight line.
[0014] Generally, although the quality of printed character of fixed level can be obtained to the repeatability of the binary picture of white and black also in the printer of an electrophotography method, the repeatability of an image including halftone is not good. Then, in a current electrophotography method, the approach of reproducing halftone in false is in use with the area gradation using a dither, and the resolution of printing at the time of using a dither falls substantially compared with the resolution in electrostatic latent-image means forming.
[0015] The matrix of a typical dither is formed by 4x4 pixels or about 6x6 pixels. The tone reproduction in that case becomes 16 steps and 36 steps, and the resolution of the image formed is set to 1/4 or 1/6. When thinking a tone reproduction as important, in order to obtain practical resolution, it is necessary to form an electrostatic latent image with dramatically high resolution.
[0016] In the printer using the conventional ion write head 1, since the repeatability of halftone is excellent, the rendering of concentration gradation is possible also for not depending on a dither, either. Therefore, it has been thought that the trouble that resolution cannot be raised because of a limit of the magnitude of openings 3 and 13 etc. is suppliable with the repeatability of concentration gradation. That is, in the application over which priority is given to a tone reproduction like a photograph, even if resolution was low, when the tone reproduction was excellent, repeatability was suppliable, but in the application as which high resolution, such as printing of an alphabetic character, is required, though some improvements could be made using the tone reproduction, there was a trouble that only the quality of printed character which was substantially inferior to the electrophotography method with high resolution was obtained.
[0017] Moreover, it sets to the conventional ion write head 1. Two or more openings 3 and 13 cannot be formed in the print width direction in a straight line. Two or more openings 3 and 13 were arranged aslant, and when the method which forms the electrostatic latent image of one line in time sharing was used, the nonuniformity of a rate was in the latent-image support 7 or the timing of writing shifted to it, there was a trouble that the location of an electrostatic latent image shifted and a quality of printed character deteriorated substantially. Moreover, a control circuit, the actuation circuit 15, etc. which are not illustrated tended to become complicated and expensive by rearrangement of an image, generating of timing, etc., ion write head 1 the very thing was enlarged, and there was a trouble that it became difficult to keep constant the distance between the ion write head 1 and the latent-image support 7.
[0018] This invention is made in view of these points, and the trouble in the conventional thing mentioned above is conquered, and it is small and aims at offering the ion write head with the high utilization effectiveness of ion.

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MEANS

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[Means for Solving the Problem] In order to attain the object mentioned above the ion write head of this invention according to claim 1 Two or more individual electrodes which are the ion write head which a charged particle is made to adhere selectively and forms an electrostatic latent image on the latent-image support constituted with a dielectric, and were formed on the substrate, The electron emission section which may emit the electron for generating a charged particle by being formed on said individual electrode and heated, It is characterized by having a heating unit for heating said electron emission section, and a gate electrode for accelerating the electron which collaborated with said individual electrode and was emitted from said electron emission section.
[0020] And the ion write head of this invention according to claim 2 is characterized by said individual electrode making said heating unit serve a double purpose in claim 1.
[0021] Furthermore, the ion write head of this invention according to claim 3 is characterized by forming said electron emission section considering a ferroelectric as a subject in claim 1 or claim 2.
[0022] Moreover, the ion write head of this invention according to claim 4 is characterized by having the actuation circuit which makes said heating unit generate heat to predetermined timing in any 1 term of claim 1 thru/or claim 3.

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OPERATION

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[Function] The ion write head of this invention which consists of a configuration mentioned above By generating ion using the so-called principle of thermionic emission, and heating the heating unit formed on the substrate Heat the electron emission section, make a thermoelectron emit from here, accelerate by the electric field to which this electron is impressed between the gate electrode and the individual electrode, and ion is generated. It can be made to be able to move to the front face of latent-image support by the electric field to which this ion is impressed between an individual electrode and latent-image support, and an electrostatic latent image can be formed in the front face of latent-image support.

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EXAMPLE

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[Example] Hereafter, the example which shows this invention to a drawing explains.
[0025] Drawing 3 shows the 1st example of the ion write head concerning this invention from drawing 1 , drawing 1 is drawing of longitudinal section showing the configuration of an important section, it is a cutting top view a part and drawing 2 is a circuit diagram showing the configuration of an important section in which drawing 3 shows an actuation circuit.
[0026] As shown in drawing 1 and drawing 2 , the heat insulating layer 18 is arranged on the substrate 17, and, as for the ion write head 16 of this example, the heater layer 19 is arranged in the top face of this heat insulating layer 18. And it is called two or more cathode electrodes which corresponded to resolution (pixel number) through the medium insulating layer 20 on the top face of the heater layer 19, for example, alignment arrangement of the individual electrode 21 which has the base 77 with a diameter of about 30 micrometers is carried out in drawing at the longitudinal direction (the print width direction) at the shape of a single tier. Furthermore, the electron emission section 22 which may emit the electron for generating a charged particle (ion) is arranged in the top face of the base 77 of the electrode 21 according to each. Moreover, the conductive layer 23 for centralizing generation of heat of the heater layer 19 to each electron emission section 22 is arranged in the top face of the heater layer 19 except for the part which counters each electron emission section 22. That is, let the part which is not covered with the conductive layer 23 corresponding to each electron emission section 22 of the heater layer 19 be the heating unit 24 for heating each electron emission section 22 in this example. On a substrate 17, it centered on each electron emission section 22, for example, the gate electrode 26 which has the circular opening 25 with a diameter of about 20 micrometers is arranged through the insulating layer 27 of proper thickness further again, and it is formed in abbreviation plate-like as a whole.
[0027] that in which thermal resistance is high and has required mechanical strength and workability as a raw material of said substrate 17 -- it is -- it is -- ****ing -- insulating materials and front faces, such as an alumina ceramic and glass, -- SiO2 etc. -- various things, such as a silicon substrate which carried out the clad with the insulating material, can be chosen.
[0028] As a raw material of said heat insulating layer 18, various things, such as high-melting glass with the small heat conductivity, foam glass, a zirconia ceramic, and a silicon dioxide, can be chosen.
[0029] As a raw material of said heater layer 19, various things, such as a tungsten, Nichrome, and tantalum nitride, can be chosen.
[0030] since big electric field are put to the ion added and generated as a raw material of said medium insulating layer 20 -- SiO2 with high insulation performance and stability, and A12 O3 etc. -- it is desirable to use the insulating material of an inorganic substance.
[0031] It is desirable to use metal raw materials, such as platinum, a tungsten, a tantalum, and molybdenum, in consideration of conductivity and workability as a raw material of said individual electrode 21.
[0032] the ferroelectric which has the thermionic-emission operation which emits an electron with heating as a raw material of said electron emission section 22, for example, barium titanate, strontium titanate, zirconic acid barium, zirconic acid strontium, etc. can be illustrated, and independent [ if

needed ] in these -- or it can combine and use.
[0033] As a raw material of said conductive layer 23, it has small electric conductivity and platinum high to thermal resistance, a tantalum, a tungsten, molybdenum, etc. are more desirable than the heater layer 19.
[0034] Various things, such as molybdenum and a tantalum, can be chosen as a raw material of said gate electrode 26.
[0035] since heat is added while big electric field are put to the ion added and generated as a raw material of said insulating layer 27 -- transparence with high insulation performance and stability with little heat loss or white SiO2, and A12 O3 etc. -- it is desirable to use the insulating material of an inorganic substance.
[0036] Moreover, as a fictitious outline shows to drawing 1 , the latent-image support 28 in which an electrostatic latent image is formed as the gate electrode 26 of said ion write head 16 is countered is arranged. While the proper dielectric layer 30 is formed in the front face of the desired metal base 29, this latent-image support 28 The fixed distance G of about 100 micrometers (gap) is separated from said gate electrode 26, it is arranged, and migration is made free with constant speed in the direction of vertical scanning which intersects perpendicularly to the main scanning direction where said each electron emission section 22 is arranged.
[0037] As shown in drawing 3 , the reference potential is formed when the actuation circuit 31 of the ion write head 16 of this example grounds the metal base 29 prepared in the opposite hand to the ion write head 16 of the latent-image support 28 as a back plate 32. While connecting electrically, let the power source VL for latent-image writing to which this actuation circuit 31 supplies the polar electrical potential difference of minus to the gate electrode 26 be a common electrode [ as opposed to the electrode 21 according to each in the gate electrode 26 ]. And each actuation transistor 33 makes the gate electrode 26 a reference potential, and the electrode 21 according to each is connected to the power source VE for electronic acceleration which impresses the polar electrical potential difference of minus to the gate electrode 26 through the current setting-out resistance 34 while connecting with the respectively proper actuation transistor 33. Moreover, the power source VH for heating is electrically connected to the heater layer 19 through the temperature control section which is not illustrated for always controlling the exoergic temperature of a heating unit 24 to fixed temperature. In addition, as for the energization of the power source VH for heating to the heater layer 19, it is desirable to control by the pulse voltage which synchronized with formation of the electrostatic latent image of each pixel based on a control command.
[0038] If said actuation circuit 31 is explained further, the actuation circuit 31 of this example will be constituted by the current regulator circuit, and the current of this current regulator circuit will be determined as the current setting-out resistance 34 connected to the emitter of each actuation transistor 33 with the electrical potential difference applied to the base of each actuation transistor 33. And the base electrical potential difference of each actuation transistor 33 is impressed by inputting the digital signal by which weighting was carried out through the D/A conversion circuit 35 which combined resistance with the ladder mold. Furthermore, the input signal over the ion write head 16 is made into the serial signal 36 in which each has another weight, and is changed into a parallel signal by the shift register 37 corresponding to each serial signal 36. Moreover, once this parallel signal is held at latch 38, it is outputted to a gate circuit 40 by the latch signal 39, takes ANDO with a strobe signal 41 by the gate circuit 40, and is inputted into the D/A conversion circuit 35. This strobe signal 41 is a signal which determines the operating time over the gate electrode 26 of the individual electrode 21.
[0039] That is, the electrode 21 according to each in this example is electrically connected to the actuation circuit which is insulated separately and has a constant current characteristic, and the heater layer 19 has connected each heating unit 24 to a serial.
[0040] In addition, power is reducible by considering as the configuration which divides the heater layer 19 and is made into two or more groups.
[0041] Below, (j) explains the production process of the ion write head 1 of this example from (a) of drawing 4 .

[0042] First, sequential membrane formation of the heat insulating layer 18 which becomes the top face of the abbreviation plate-like proper substrate 17 which consists of insulating materials, such as glass, from a silicon dioxide, the heater layer 19 which consists of tantalum nitride, and the conductive layer 23 which consists of a tantalum is carried out using the well-known thin film formation approach. And etching etc. removes the position of the heater layer 19 and a conductive layer 23 in the same configuration, and as shown in (a) of drawing 4 , and (b), the heater layer 19 and a conductive layer 23 are formed in a predetermined configuration. Subsequently, as etching etc. removes the position of a conductive layer 23 and it is shown in (c) of drawing 4 , and (d), the predetermined part of the heater layer 19 is exposed and a predetermined number corresponding to the number of pixels of heating units 24 are formed. the next -- SiO2 from -- after forming the becoming medium insulating layer 20 similarly using the well-known thin film formation approach, as shown in (e) of drawing 4 , and (f), only the predetermined number corresponding to the number of pixels forms the individual electrode 21 which consists of metals, such as a tantalum, using the well-known thin film formation approach and well-known etching. the next -- SiO2 from -- as the becoming insulating layer 27 and the gate electrode 26 which consists of metals, such as a tantalum, are similarly shown in (g) of drawing 4 , and (h) after ****** one by one, etching etc. removes the position of the gate electrode 26 and the opening 25 of desired magnitude is formed. Subsequently, etching etc. removes the position of an insulating layer 27, and as shown in (i) of drawing 4 , the individual electrode 21 located under the opening 25 is exposed. By carrying out migration electrodeposition of the electrodeposted liquid which contains a ferroelectric on the individual electrode 21 next, and forming an electrodeposited film, the electron emission section 22 is formed and manufacture of the ion write head is completed. In addition, when forming the electron emission section 22, after forming the proper mold release layer (not shown) by the photoresist etc. on the gate electrode 26 at the process and forming the electron emission section 26 before forming the electron emission section 22, it is good to remove a mold release layer.

[0043] Below, it explains in more detail about formation of the electron emission section 22 of the ion write head 16 of this example.

[0044] In order to form the electron emission section 22 of this example, the electrodeposted liquid which uses a ferroelectric as a principal component is formed first. This electrodeposted liquid grinds the ferroelectric powder of perovskite molds, such as barium titanate, to particle-size extent of 1 micrometer or less with wet grinding, washes it with pure water, and removes impurities, such as a barium hydroxide. Next, 1% (wt%) of pure water as an electrolyte and 0.0012% (wt%) of calcium chlorides are added to a methanol, and the electrolytic solution is formed. Next, electrodeposted liquid is formed by adding the powder of a ferroelectric compound to said electrolytic solution 0.15%. PH of this electrodeposted liquid is a little less than seven, and conductivity is 30microS/cm extent. Although the ferroelectric compound itself is chemically stable and the solubility to water is small at this time, oxides, such as unreacted barium and titanium, react with water, turn into a hydroxide, and dissolve in water, and in order to reduce the resistivity of electrodeposted liquid, it is necessary to remove them beforehand. Moreover, in electrodeposted liquid, the calcium chloride in the electrolytic solution is ionized in calcium ion and a chloride ion, and is incorporated as a calcium hydroxide in the electrodeposited film formed. Subsequently, after stirring electrodeposted liquid, by putting for several hours, a ferroelectric compound with a large particle size is made to sediment, it removes, and manufacture of electrodeposted liquid is completed.

[0045] An electrodeposited film is formed on [ classified by each ] an electrode 21 by using the individual electrode 21 of the ion write head 16 as cathode, applying an about [ 50V ] electrical potential difference using the platinum which is hard to ionize to an anode plate, and next, performing migration electrodeposition. The current density at the time of this migration electrodeposition is 2 70mA/cm. Extent and an electrodeposition rate are good to consider as 1 micrometer/min extent.

[0046] The electron emission section 22 is formed on [ classified by each ] an electrode 21 by performing heat treatment heated at about 200-300 degrees C in atmospheric air for several hours next, removing a methanol, and heating in atmospheric air or a vacuum at the temperature of about 600 degrees C after that for several hours. In addition, the calcium hydroxide incorporated in the

electrodeposited film reacts with the carbon dioxide in atmospheric air by heat treatment, a part serves as a calcium carbonate, the remainder serves as a calcium oxide, and these lime compounds carry out the duty of cement which hardens between the fine particles of a ferroelectric (ferroelectric compound), and make firm the electrodeposited film used as the electron emission section 22 formed on [ classified by each ] the electrode 21.

[0047] Next, the ion write head 16 of this example was put into the vacuum tub, the electron emission section 22 was heated, and the amount of electron emission (emission) was evaluated. Whenever [ stoving temperature ] was gradually made high and the process which emission increases from a minute current field was recorded. The emission to each temperature is the same level as the thermionic-emission raw material of the oxide covering form of common barium or calcium, and has checked that a work function was almost equal. Moreover, when it was made to operate at the temperature for several hours, it has checked that the property was stable.

[0048] Subsequently, when the pressure of a vacuum tub was gradually made high toward the atmospheric pressure condition from the vacua and the property in the inside of atmospheric pressure was evaluated eventually, it became clear by enlarging the electric field between the individual electrode 21 and the gate electrode 26 that an electron could be efficiently emitted from the electron emission section 22. And the current which can be taken out from the electron emission section 22 was proportional to the electric field between the individual electrode 21 and the gate electrode 26, and while having a relation in inverse proportion to a distance in the meantime, it became clear that the current which can be taken out in atmospheric air was 1/100 to about 1/1000 as compared with the case in a vacuum.

[0049] Below, an operation of the ion write head 16 mentioned above is explained.

[0050] If the ion write head 16 of this example is made to drive and the current of the power source VH for heating is energized in the heater layer 19, the heating unit 24 formed in the heater layer 19 will generate heat, and generation of heat of this heating unit 24 will heat the individual electrode 21 and the electron emission section 22 to predetermined temperature. And the heated electron emission section 22 emits an electron (thermoelectron) to the space of the outside of the electron emission section 22 by the principle of thermionic emission.

[0051] The electron emitted to the space of the outside of said electron emission section 22 is caught by the oxygen molecule in the space between the gate electrode 26 and the latent-image support 28, after being accelerated by the electric field formed of the electrical potential difference of the power source VE for electronic acceleration impressed between the individual electrode 21 and the gate electrode 26, and it becomes oxygen ion, and the polar ion (not shown) of minus as a charged particle is generated. This ion moves toward the front face of the latent-image support 28 by the electric field which are impressed between the gate electrode 26 and the back plate 32 of the latent-image support 28, and are formed of the electrical potential difference of the power source VL for slack latent-image writing.

[0052] Moreover, the ion write head 16 of this example The electrode 21 according to each is formed in the shape of a single tier using a certain thin film formation approach, etching, etc. from the former. While being formed by making the upper part electrodeposit the electron emission section 22 and being able to form easily the electrode 21 according to each and the electron emission section 22 of complicated and detailed structure It can form in the shape of a line, and the resolution of the ion write head 16 can be raised easily.

[0053] Below, generation of ion and migration of ion are explained.

[0054] In this example, the gap G between the gate electrode 26 and the latent-image support 28 is set to 100 micrometers, potential of the gate electrode 26 is set to -500--600V to the back plate 32 of the latent-image support 28, and the electric field between the gate electrode 26 and the latent-image support 28 are carried out [ mm ] in 5-6kV /. The value of this electric field is a value of one half extent of the sparkover voltage in the atmospheric air in the gap G between the gate electrode 26 and the latent-image support 28.

[0055] Moreover, when an electron is made to emit into atmospheric air by heating the electron emission section 22 The mean free path of the oxygen molecule in about 400nm and atmospheric air of

the mean free path of the electron in the inside of the air of atmospheric pressure is 64nm. The emitted electron is 103-104, while carrying out the drift of the between with a gap [ G ] of 100 micrometers. It collides with the gas molecule in time atmospheric air, it is caught by an oxygen molecule and the molecule of a steam probable, and the polar ion (O2-ion) of minus as a charged particle is generated. At this time, about by 2x10 to four, where ion and an electron are mixed, the probability for the electron of low energy to be caught by the oxygen molecule serves as an ionic current, arrives at the front face of the latent-image support 28, and it gives the polar charge of minus to the front face of the latent-image support 28, and the polar detailed electrostatic latent image of minus is formed in the front face of the latent-image support 28. That is, surface potential of the latent-image support 28 of an initial state (before an electrostatic latent image is written in) is set to 0V by electric discharge, and the electrostatic latent image of the potential which is proportional to the amount of attainment of the polar ion of minus of an electron on reception and its front face from the polar ion of the minus which arrived at the front face of the latent-image support 28 is formed. Since the ion and electron which arrive at the front face of the latent-image support 28 at this time move to line of electric force at parallel, that breadth can be disregarded until electrostatic latent-image potential is saturated. The maximum of the potential of this electrostatic latent image is saturated with the value near the electrical potential difference of the power source VL for latent-image writing.

[0056] Therefore, the polar ion of the minus which arrived at the front face of the latent-image support 28 after the potential of an electrostatic latent image was saturated moves to the one where latent-image potential is smaller along the front face of the latent-image support 28, and gives a charge to the front face of the part. That is, the electrostatic latent image on the latent-image support 28 will spread in concentric circular. The breadth of this electrostatic latent image decreases, so that the gap G between the gate electrode 26 and the latent-image support 28 is short.

[0057] The mass of said ion is 5.9x104 of an electron. It is about twice, and passing speed of the ion by the electric field between said gate electrodes 26 and back plates 32 of the latent-image support 28 is made into 100 m/S extent, and the transit time of the ion between said gaps G of 100 micrometers becomes about [ 1micro ] S.

[0058] Here, the time amount which the magnitude of one pixel (dot) will be about 84.67-micrometer angle, and the writing of one line will take the resolution of image formation if passing speed (process rate) of 300DPI and the latent-image support 28 is made into 100 mm/S is set to 847microS, and since the passing speed of ion is fully shorter than the write time of one line, it does not become the failure of the writing of an electrostatic latent image.

[0059] Moreover, when there is little emission from the electron emission section 22, the ionic current which the electrical potential difference of the gate electrode 26 is subtracted to the potential of the electron emission section 22, and the potential of the part near the opening 25 of the space around the electron emission section 22 is subtracted, and becomes from ion and an electron is converged on the core of the opening 25 of the gate electrode 26. The convergence rate of the ionic current to the opening 25 of this gate electrode 26 becomes about 3 times at the maximum.

[0060] that is, the amount of the ion which concentrates the magnitude of the electrostatic latent image formed on the latent-image support 28 on the small diameter which line of electric force reaches when there are few amounts of the polar ion of the minus which arrives at the front face of the latent-image support 28, and reaches -- increasing -- ** -- the polar potential of minus of the electrostatic latent image which is not rises, and the line of electric force which arrives at the front face of the latent-image support 28 spreads. The area of a breadth electrostatic latent image will be expanded to concentric circular by the polar ion of the minus which takes and reaches it on the front face of the latent-image support 28.

[0061] Therefore, linearity of the area of the electrostatic latent image over the amount of the generated ion can be made very high.

[0062] [ when developing an electrostatic latent image with a toner and considering as a toner image ] namely, the linearity of the coating weight of a toner By the case where the area of the electrostatic latent image of the case where the potential of an electrostatic latent image has halftone, and fixed potential changes Since area gradation can form the electrostatic latent image of a detailed area also in a

low printing concentration field and printing by wide range area gradation is attained, the ion write head 16 of this example The high-definition quality of printed character in which the repeatability of gradation was extremely excellent compared with the conventional ion write heads 1 and 1a can be obtained. This quality of printed character is excellent also to the quality of printed character of an electrophotography method which has the high resolution used for the application as which high resolution, such as printing of an alphabetic character, is required.

[0063] Amplification of the area of said electrostatic latent image does not necessarily break out indefinitely, and is restricted to the fixed range according to the amount of the ion which reaches by the electric field impressed between the gate electrode 26 and the back plate 32 of the latent-image support 28. Moreover, the potential of the electrostatic latent image formed is also restricted to the almost fixed value near the electrical potential difference impressed between the gate electrode 26 and the back plate 32 of the latent-image support 28.

[0064] Although the gap G between said gate electrodes 26 and latent-image support 28 is restricted by the precision of the gap G between the gate electrode 26 at the time of making it run the danger and the latent-image support 28 of the short circuit by trespass of a toner, and the latent-image support 28, as for the gap G between the gate electrode 26 and the latent-image support 28, it is desirable to constitute so that the distance G of abbreviation regularity may always be held.

[0065] In addition, since it collides with the front face of the gate electrode 26 with which the polar ion of the plus which exists in atmospheric air is formed in the front face of the ion write head 16 of the electric field between the gate electrode 26 and the latent-image support 28, and potential is [ area ] large subtracted most, the probability which carries out the spatter of the electron emission section 22, and is exhausted is very small, and the electron emission section 22 can hold the function continued and stabilized at the long period of time.

[0066] Moreover, since the rate which ion moves is proportional to the magnitude of electric field, it is desirable to consider as high electric field within limits which do not carry out dielectric breakdown.

[0067] Below, a current required for electrostatic latent-image formation is explained.

[0068] The potential of the electrostatic latent image formed in the front face of said latent-image support 28 is decided by the ratio of the electrostatic capacity of the dielectric layer 30 of the ion or electronic charge which reaches the latent-image support 28, and the latent-image support 28. Here, when thickness of the dielectric layer 30 of the latent-image support 28 is set to 20 micrometers and the dielectric constant is set to 2.5, it is 2 1cm. The electrostatic capacity of a hit is set to 110.7pF. The charges taken to electrify the dielectric layer 30 of this latent-image support 28 from OV to -500V are 55.35nC(s). When width of face of the image recording of the latent-image support 28 is made to 210mm and a process rate is made into 100 mm/s, a current required of the ion write head 16 whole is 11.62microA. The number of pixels at the time of setting the die length of the printing section to 210mm becomes 2480 pieces in 300DPI, becomes 3307 pieces in 400DPI, and the average current per electrode 21 according to each serves as 4.69nA(s) in 300DPI, and it serves as 3.51nA(s) in 400DPI.

[0069] When magnitude of said individual electrode 21 is made into the diameter of 30 micrometers, the area is 7.07x10 to 6 cm2. Current density is 497microA/cm2 in 663microA/cm2 and 400DPI at 300DPI. It becomes. And 100 mA/cm2 in the case of operating the individual electrode 21 in a vacuum in respect of current density Although it is quite small, it is equivalent level when it takes that ion or electrons are scattered about in atmospheric air, and mobility falls into consideration. The magnitude of this individual electrode 21 is restricted by current density and the dimensional accuracy by the processing technique.

[0070] Below, the tone reproduction at the time of using a liquid phenomenon is explained.

[0071] As for the tone reproduction at the time of using a liquid phenomenon, the resolution of the ion write head 16 serves as a determinant. The diameter of 30 micrometers and the gate electrode 26 is set to 20 micrometers for the diameter of the individual electrode 21, the minimum of the magnitude of an electrostatic latent image is set to 7 micrometers, the upper limit of the magnitude of an electrostatic latent image serves as 84.67-micrometer angle in 300DPI, and the ion write head 16 in this example serves as 63.5-micrometer angle in 400DPI. And dot area in case the diameter of an electrostatic latent

image is 7 micrometers is 2 38.5 micrometers. Becoming, an area of 1 pixel of each resolution is 2 4032 micrometers in 2 and 400DPI 7069 micrometers at 300DPI. It becomes, and it can become 183.6 times in 300DPI, it can become 104.7 times in 400DPI, and surface ratio can be made without a dither into outline 128 gradation (7 bits) extent. Furthermore, each color 256 gradation (8 bits) 1,670,000 color specification is possible by the dither of a 2-4-pixel unit.

[0072] Below, the tone reproduction of a using-dry developing case is explained.

[0073] As for the tone reproduction at the time of using dry developing, the particle size of a toner serves as a determinant. Whenever [ by the current grinding method / high image ], a typical particle size of a toner is about 7 micrometers, and the minimum of the magnitude of an electrostatic latent image is set to about 14 micrometers. The dot area in this case is 2 153.9 micrometers. The surface ratio of an electrostatic latent image becomes 45.9 times in 300DPI, and becomes 26.2 times in 400DPI, and processing of a dither becomes unnecessary when the printing concentration of each pixel is larger than the minimum value determined by the above-mentioned surface ratio, since the linearity of the magnitude of an electrostatic latent image is high. Moreover, when printing concentration is smaller than the minimum value of the above-mentioned surface ratio, in order to obtain a gradation rendering with a color [ each ] of 8 bits, it is good to use the dither of 9 dots of 3x3, and the matrix of the 16-dot unit of 4x4.

[0074] Below, the resolution in ion writing is explained.

[0075] According to the printer using the ion write head 16 of this example, it can reappear without 8-bit (256 gradation's) a total of 1,670,000 colors' almost using a dither for three primary colors respectively, and resolution of an image can be made into the level near a photograph or a sublimation mold.

[0076] In the case of the image of the bit map of a color, there will be few pixels of a great portion of data because of a limit of amount of information than the number of pixels of the image constituted by the ion write head 16, and it will expand with software, and will print. As the typical number of pixels, 640 dots wide, the length of 480 dots, and the amount of information of 24 bits (1,670,000 colors) become 900 K bytes, when not compressing data. The resolution in the case of printing the image in 8cm wide and 6cm long magnitude is set to mm in 8 dots (about 200 DPI) /. It is possible to acquire the 300 - 400DPI ****** as the usual page printer with the same resolution and repeatability faithful except when printing an image with high resolution specially.

[0077] Moreover, according to the printer using the ion write head 16 of this example, although overwhelmingly excelled to the electrophotography method etc. in the repeatability of concentration gradation, in printing of an alphabetic character without gradation, the resolution of a print head becomes the factor which determines image quality. Although the resolution of the direction (main scanning direction) where the pixel of the line head as a print head is located in a line is decided by resolution of a print head The number of the individual electrodes 21 used as the number of the pixels in the ion write head 16 of this example It is easy to make it subdivide to the direction (the direction of vertical scanning) to which the latent-image support 28 or a printing medium moves (increment). In printing of an alphabetic character, the notch of the edge of the printed alphabetic character can be made smooth by making the number of the individual electrodes 21 in the ion write head 16 increase, and making resolution high.

[0078] Therefore, while the ion write head 16 of this example can make electrostatic latent-image formation generate the ion of only a complement on real time unlike the conventional ion write heads 1 and 1a by the corona discharge and high frequency discharge using high tension, integration of the actuation circuit 31 becomes easy, and while the price can miniaturize and fall certainly, resolution can be raised certainly.

[0079] Drawing 8 shows the 2nd example of the ion write head concerning this invention from drawing 5 , drawing 5 is drawing of longitudinal section showing the configuration of an important section, drawing 6 is a gate electrode and the top view which excluded the insulating layer, drawing 7 is the sectional side elevation of drawing 6 , and drawing 8 is the circuit diagram showing an actuation circuit.

[0080] Ion write head 16a of this example is taken as the configuration which carried out grouping of the individual electrode 21 while the individual electrode 21 of said 1st example serves as the function of

the heater layer 19.
[0081] As shown in drawing 5 , the heating individual electrode layer 42 of the predetermined configuration for making the heater layer 19 and the individual electrode 21 of the 1st example which the heat insulating layer 18 is arranged on the substrate 17, and mentioned above ion write head 16a of this example in the top face of this heat insulating layer 18 serve a double purpose is arranged. And the conductive layer 23 is arranged in the top face of the heating individual electrode layer 42. Furthermore, the heating individual electrode layer 42 and the conductive layer 23 are etched into the same predetermined configuration. Moreover, the position of the conductive layer 23 on the heating individual electrode layer 42 is removed by etching etc., and, thereby, the heating unit 24 on which generation of heat of the heating individual electrode layer 42 is centralized to the electron emission section 22, and individual electrode 21a called the cathode electrode corresponding to resolution (pixel number) are formed. This individual electrode 21a is made into magnitude with a diameter of about 30 micrometers, and as shown in drawing 5 and drawing 6 , alignment arrangement is carried out at the longitudinal direction (the print width direction) at the shape of a single tier. And the electron emission section 22 which may emit the electron for generating a charged particle (ion) is arranged in the top face of electrode 21according to each a. Moreover, on the heat insulating layer 18, it centered on each electron emission section 22, for example, the gate electrode 26 which has the circular opening 25 with a diameter of about 20 micrometers is arranged through the insulating layer 27 of proper thickness, and it is formed in abbreviation plate-like as a whole.
[0082] As a raw material of said heating individual electrode layer 42, platinum, a tantalum, molybdenum, a tungsten, etc. are suitable.
[0083] That is, in ion write head 16a of this example, while the part which is not covered with the conductive layer 23 of the heating individual electrode layer 42 is set to individual electrode 21a, it is set to heating unit 24a for heating each electron emission section 22, and it has the composition that the electron emission section 22 is directly formed on individual electrode 21a. Moreover, as shown in drawing 6 , grouping of the heating individual electrode layer 42 in this example is carried out so that four individual electrode 21a may become 1 set. It is not especially limited to the number of individual electrode 21a of this example that what is necessary is for resolution, a design concept, etc. of ion write head 16a just to determine the number of individual electrode 21a in this 1 group.
[0084] As shown in drawing 8 , actuation circuit 31of ion write head 16a of this example a is constituted so that time sharing of the electrode 21according to each a may be carried out and it may be heated, and the power source VH for heating is connected to electrode 21according to each a through the DC/DC conversion circuit 43 of an insulating mold, and the heater change-over circuit 44 as a switch for the on/off of every electrode 21according to each a. And the heater change-over signal 46 which carries out on/off of the heater change-over circuit 44 through the photo coupler 45 corresponding to electrode 21according to each a is inputted into the heater change-over circuit 44. Other configurations are the same as that of the actuation circuit 31 of the 1st example mentioned above.
[0085] By considering as such a configuration, this example By considering as the configuration which forms the electronic radiator 22 directly on individual electrode 21a which served as the heating unit 24, while doing so the same effectiveness as the 1st example mentioned above While a production process can be simplified, being able to reduce the number of production processes and being able to reduce an economic burden certainly Since a miniaturization can be attained and (the amount of accumulation) can be made small for heat capacity, the responsibility over a temperature change can be raised and heating time for the electron emission section 22 to emit an electron can be shortened. Moreover, since the medium insulating layer 20 in the 1st example can be excluded, there is no temperature gradient and the utilization effectiveness of heat can be raised certainly.
[0086] Drawing 11 is the top view showing the configuration of the important section which excluded the gate electrode and the insulating layer, drawing 13 shows the 3rd example of the ion write head concerning this invention from drawing 9 , drawing 9 is drawing of longitudinal section showing the configuration of an important section, drawing 10 is the top view of drawing 9 , and drawing 13 is [ drawing 12 is the sectional side elevation of drawing 11 , and ] the circuit diagram showing an

actuation circuit.
[0087] Ion write head 16b of this example is taken as the configuration which divided the gate electrode 26 so that it might correspond to electrode 21according to each a of said 2nd example.
[0088] Gate electrode 26a divided by the insulating layer 27 is arranged, and as shown in drawing 12 from drawing 9 , ion write head 16b of this example is formed so that the configuration of the heating individual electrode layer 42 may also correspond to gate electrode 26a, so that it may correspond to electrode 21according to each a formed in the heating individual electrode layer 42. Other configurations are the same as that of ion write head 16a of the 2nd example mentioned above.
[0089] As shown in drawing 13 , while time sharing of the actuation circuit 31of ion write head 16b of this example b is carried out and it heats each gate electrode 26a, it is constituted so that electrode 21according to each a may be heated for every group, and the power source VL for latent-image writing is connected to each date electrode 26a through the gate change-over circuit 47 as a switch for the on/off of each gate electrode 26a of every. He is trying for this gate change-over circuit 47 to operate with the gate change-over signal 48. Moreover, the power source VH for heating is connected to individual electrode 21a by which grouping was carried out per four pieces through the DC/DC conversion circuit 43 of an insulating mold. Other configurations are the same as that of actuation circuit 31a of the 2nd example mentioned above.
[0090] This example can do so the same effectiveness as the 2nd example mentioned above by considering as such a configuration.
[0091] Below, drawing 18 explains the structure of holding uniformly the distance G of the gate electrode 26A (a sign names generically the gate electrodes 26 and 26a) and the latent-image support 28 of each ion write head 16A (a sign names generically the ion write heads 16, 16a, and 16b) of this example, from drawing 14 .
[0092] Drawing 14 shows the 1st example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0093] This example uses for a front face the dielectric drum 49 which has a dielectric layer 30 as latent-image support 28.
[0094] In this example, the proper contact rollers 50 and 50 are arranged in the both ends of the longitudinal direction which is the print width direction of ion write head 16A, and the dielectric drum 49 is arranged through these contact rollers 50 and 50. And they are contacted with the front face of the dielectric drum 49 while they are arranged free [ a revolution ], as each contact rollers 50 and 50 avoid the printing area of the front face of the dielectric drum 49. furthermore, the proper pressurization contacted with the support frame which ion write head 16A is supported free [ migration in the direction of the normal of the front face of the dielectric drum 49 ], and was arranged in the tooth back of ion write head 16A, and which is not illustrated -- it enables it to hold a predetermined distance (spacing) to the front face of the dielectric drum 49 with the thrust of a spring 51 In addition, contact pressure of each contact roller 50 may be made small, and the printing area of the dielectric drum 49 may be made to contact.
[0095] Drawing 15 shows the 2nd example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0096] In this example, like the 1st example shown in drawing 14 , the contact roller 50 is not arranged in ion write head 16A, but the desired blade 52 as a cleaning means which makes the dielectric drum 49 at clarification the lower part of ion write head 16A is arranged instead. And the proper waste toner receptacle 53 is arranged at the lower part of a blade 52. Moreover, he is trying to touch the dielectric drum 49 with the record media 55, such as a form, in imprint / fixation section 54 caudad shown in drawing 15 .
[0097] By such configuration as well as the 1st example which is shown in drawing 14 and which was mentioned above, the distance of the gate electrode 27A and the latent-image support 28 of ion write head 16A can be held uniformly.
[0098] Drawing 16 shows the 3rd example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support, (a) is a perspective view and (b) is drawing of

longitudinal section.
[0099] The dielectric belt 56 of the shape of an endless belt which has flexibility as latent-image support 28 is used for this example.
[0100] The proper belt attachment component 57 is arranged in ion write head 16A, the dielectric belt 56 is positioned to ion write head 16A, and the distance of gate electrode 26A which ion write head 16A does not illustrate, and the front face of the dielectric belt 56 is made to ** uniformly in this example. In this case, it is important to set thickness of the dielectric belt 56 constant.
[0101] Since the location of ion write head 16A is easily fixable as compared with the configuration using the dielectric drum 49 shown in drawing 14 and drawing 15 according to such a configuration, it is advantageous when holding uniformly the distance of the gate electrode 27A and the latent-image support 28 of ion write head 16A.
[0102] Drawing 17 shows the 4th example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0103] This example uses the dielectric belt 56 as latent-image support 28 like the 3rd example shown in drawing 16 .
[0104] It pushes against the belt attachment component 57a side which arranged the front face of the dielectric belt 56 so that the front face of ion write head 16A might be covered, and distance is made to hold uniformly in this example. And it forms in belt attachment component 57a of this example by the insulating layer 59 which consists of a proper insulator so that the electrostatic latent image formed in the front face of the dielectric belt 56 in the downstream front face 58 of ion write head 16A may not be disturbed. In addition, while making the downstream front face 58 of ion write head 16A not contact the front face of the dielectric belt 56, the conductive layer 61 which becomes the inlet face 60 of ion write head 16A from a conductive ingredient is formed, and it may be made to discharge the dielectric belt 56.

[0105] Drawing 18 shows the 5th example of the structure of holding uniformly the gate electrode of the ion write head, and the distance of latent-image support.
[0106] This example makes the structure of the 4th example shown in drawing 17 inject a fluid (air) toward the dielectric belt 56 from the front face of ion write head 16A, and it is made to surface the dielectric belt 56 in fixed height from the front face of ion write head 16A.
[0107] In this example, it prepares in each [ the proper orifice 63 for maintaining the balance of the flow rate of the air which flows each nozzle 62 while forming two or more nozzles 62 is connected / each / front face / of head attachment component 55a / at each nozzle 62 ] passage 64, and supply of application-of-pressure air is enabled to each passage 64. In addition, the flying height to ion write head 16A of the dielectric belt 56 is good to be referred to as about 50 micrometers.
[0108] According to such a configuration, the dielectric belt 56 is not influenced of the conductive existence of the front face of ion write head 16A in order not to contact ion write head 16A. Moreover, since the toner which adheres to the front face of the dielectric belt 56 with the pressure of air and which is not illustrated can be eliminated outside, the inconvenience that a toner adheres to the electron emission section can also be prevented certainly.
[0109] Below, drawing 21 explains the printer which used ion write head 16A of this example from drawing 19 .
[0110] Drawing 19 shows the 1st example of the printer concerning this invention.
[0111] The dielectric drum 49 is used for the printer 65 of this example as latent-image support 28.
[0112] As shown in drawing 19 , the printer 65 of this example The dielectric drum 49 is arranged free [ a revolution ] by the clockwise rotation shown by the arrow head in drawing 19 . Ion write head 16A as latent-image means forming which forms in the perimeter of this dielectric drum 49 clockwise the electrostatic latent image corresponding to the image of the request which is not illustrated on the dielectric drum 49 from the upper part in drawing 19 , The proper development counter 66 as a development means to develop with the toner which does not illustrate an electrostatic latent image, The application-of-pressure roller 67 as an imprint fixation means by which it is established while imprinting the electrostatic latent image which the toner developed on the record media 55, such as a form, The

cleaner 69 which has the proper metal blade 68 as a cleaning means which makes the dielectric drum 49 clarification, and proper AC electric discharge machine 70 as an electric discharge means to remove the electrification condition of the dielectric drum 49 are arranged in order, and are formed.
[0113] The toner (not shown) of the same plus electrification as the normal development using the photo conductor of minus electrification is used for said development counter 66, and it is used especially for the sleeve 71 of a development counter 66 with touch-down potential, without applying bias voltage.
[0114] Moreover, an imprint and fixation make the contact force of a request of the application-of-pressure roller 67 have and contact the dielectric drum 49, and push a record medium 55 against the dielectric drum 49, and the pressure of said contact pressure performs them simultaneously. While fixation becomes possible by this, without using a heat fixing assembly and decreasing power consumption, warm-up time can be made unnecessary.
[0115] Moreover, although the blade (not shown) of the cleaner used for the conventional electrophotography is made into the product made of rubber since a photo conductor (not shown) tends to get damaged, since the blade 68 of the cleaner 69 of the printer 65 of this example has the high reinforcement of the dielectric drum 49, a metal thing can be used for it, and it can raise the precision of a blade 68, and endurance certainly. And for electric discharge of the dielectric drum 49, AC electric discharge machine 70 can neutralize the charge of the front face of the dielectric drum 49 efficiently using the ion of the amphipathy of plus and minus.
[0116] According to the printer 65 of this example which consists of such a configuration, while being able to obtain a high-definition quality of printed character with the conjointly very high repeatability of gradation with the effectiveness of ion write head 16A mentioned above, it can use for various applications.
[0117] Drawing 20 shows the 2nd example of the printer using the head concerning this invention.
[0118] The dielectric belt 56 is used for printer 65a of this example as latent-image support 28.
[0119] as shown in drawing 20 , while being supported free [ a revolution ] in printer 65a of this example -- up and down -- alienation -- two rollers 72 and 73 made into the condition are arranged, either of the rollers 72 and 73 is used as a drive roll, and another side is considered as the follower roll. And as the peripheral face of each roller 72 and 73 is contacted, the dielectric belt 56 is wound. Furthermore, transit of the dielectric belt 56 in the direction shown by the arrow head in drawing 20 with said each rollers 72 and 73 is enabled.
[0120] Ion write head 16A as latent-image means forming which forms in the method of the lower left of said dielectric belt 56 the electrostatic latent image corresponding to the image of the request which is not illustrated is arranged. And the proper development counter 66 as a development means to develop to the method of the lower right of the dielectric belt 56 with the toner which does not illustrate an electrostatic latent image is arranged. Furthermore, the proper cleaner 69 as a cleaning means which carries out clarification of the dielectric belt 56 is arranged at the up left of the dielectric belt 56. Moreover, between ion write head 16A and a cleaner 69, proper AC electric discharge machine 70 as an electric discharge means to remove the electrification condition of the front face of the dielectric belt 56 as it counters with the dielectric belt 56 is arranged.
[0121] The ion generator 74 as electrostatic image transfer which imprints the electrostatic latent image which the horizontal left shown by the arrow head in drawing 20 developed with the toner through the record medium 55 whose transit was enabled on a record medium is arranged in the upper part of said dielectric belt 56. This ion generator 74 is made into the structure of having the same electron emission section 22 as ion write head 16A.
[0122] Moreover, the fixing roller 75 as a fixation means to fix a toner to a record medium 55 according to an operation of heat, and the application-of-pressure roller 76 which has elasticity enable pinching of a record medium 55, and is arranged at the transit direction downstream of a record medium 55.
[0123] According to printer 65a of this example which consists of such a configuration, the same effectiveness as the printer 65 of the 1st example mentioned above is done so. And the structure of the ion generator 74 used for the electrostatic image transfer of this example does not have the need for image formation, and since there are also few homogeneous demands of a current, the number of the

electron emission sections 22 can be reduced, or it can enlarge distance between the ion generator 74 and the dielectric belt 56. Furthermore, since the toner to a record medium 55 is established with a fixing roller 75 and the application-of-pressure roller 76, generating of the gloss of the record medium 55 by crushing the record medium 55 and toner at the time of using the application-of-pressure roller 67 of the printer 65 of the 1st example mentioned above by the high pressure and a toner can be prevented certainly, and a more nearly high-definition quality of printed character can be obtained. Moreover, since the ion generator 74 has the high consistency of the generated ion compared with the generating means of other ion, such as corotron which is not illustrated, an imprint field is limited, and the ion generator 74 can prevent degradation of the image by imprint certainly while miniaturizing like ion write head 16A and being able to operate it with a low battery and a low power. Furthermore, the ion generator 74 is the same polarity as ion write head 16A, and since it can be made to operate with few currents, the power source of the actuation circuit which ion write head 16A does not illustrate can be shared. This can decrease an economic burden certainly while being able to attain certainly the miniaturization of the actuation circuit of the whole printer 65a, equipment (not shown), etc.

[0124] Drawing 21 shows other examples of the printer which used the dielectric belt as latent-image support.

[0125] The ion generator 74 as electrostatic image transfer which imprints the electrostatic latent image which the toner developed like printer 65a of the 2nd example mentioned above in printer 65b of this example on a record medium 55 is not arranged. As an imprint fixation means fixed while imprinting a toner to a record medium 55 instead, as a fixing roller 75 and the application-of-pressure roller 76 pinch dielectric belt 56a formed with heat-resistant raw materials, such as polyimide, they are arranged. This fixing roller 75 caudad Two rollers 72 and 73 are arranged at parallel at right and left, and as said dielectric belt 56a contacts each peripheral face of said fixing roller 75 and two rollers 72 and 73, it is wound around it.

[0126] Ion write head 16A as latent-image means forming which forms in the lower part of said dielectric belt 56a the electrostatic latent image corresponding to the image of the request which is not illustrated is arranged, and the proper development counter 66 as a development means to develop to the method of the lower right of dielectric belt 56a with the toner which does not illustrate said electrostatic latent image is arranged. Furthermore, the proper cleaner 69 as a cleaning means which makes dielectric belt 56a clarification is arranged at the method of the lower left of dielectric belt 56a, and proper AC electric discharge machine 70 as an electric discharge means to remove the electrification condition of dielectric belt 56a as the upper part is countered with dielectric belt 56a is arranged.

[0127] While doing so the same effectiveness as printer 65a of the 2nd example mentioned above according to printer 65b of this example which consists of such a configuration, **** of the image at the time of an imprint can be prevented more certainly, and a more nearly high-definition quality of printed character can be obtained, and a miniaturization can be attained easily. In addition, the heater element of a single dimension like a thermal head or a 2-dimensional heating element can also be used instead of a fixing roller 75.

[0128] Moreover, this invention is not limited to said each example, and the combination of said each ion write heads 16, 16a, and 16b, said individual electrodes 21 and 21a, and each of said actuation circuits 31, 31a, and 31b can be chosen from the thing of various kinds of combination that what is necessary is for a design concept just to determine.

[0129] This invention is not limited to said each example, and can be changed further again if needed.

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[Translation done.]

* NOTICES *



1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] Drawing of longitudinal section showing the configuration of the important section of the 1st example of the ion write head concerning this invention
[Drawing 2] Drawing 1 is a cutting top view a part.
[Drawing 3] The circuit diagram showing the actuation circuit of the 1st example of the ion write head concerning this invention
[Drawing 4] (j) is an explanatory view explaining the production process of the 1st example of the ion write head concerning this invention from (a).
[Drawing 5] Drawing of longitudinal section showing the configuration of the important section of the 2nd example of the ion write head concerning this invention
[Drawing 6] The top view which excluded the gate electrode and insulating layer of the 2nd example of the ion write head concerning this invention
[Drawing 7] The sectional side elevation of drawing 6
[Drawing 8] The circuit diagram showing the actuation circuit of the 2nd example of the ion write head concerning this invention
[Drawing 9] Drawing of longitudinal section showing the configuration of the important section of the 3rd example of the ion write head concerning this invention
[Drawing 10] The top view showing the configuration of the important section of the 3rd example of the ion write head concerning this invention
[Drawing 11] The top view showing the configuration of the important section which excluded the gate electrode and insulating layer of the 3rd example of the ion write head concerning this invention
[Drawing 12] Drawing 12 is the sectional side elevation of drawing 11 .
[Drawing 13] The circuit diagram showing the actuation circuit of the 3rd example of the ion write head concerning this invention
[Drawing 14] The perspective view of an important section showing the 1st example of the structure of holding uniformly the gate electrode of the ion write head and the distance of latent-image support concerning this invention
[Drawing 15] The side elevation of an important section showing the 2nd example of the structure of holding uniformly the gate electrode of the ion write head and the distance of latent-image support concerning this invention
[Drawing 16] The 3rd example of the structure of holding uniformly the gate electrode of the ion write head and the distance of latent-image support concerning this invention is shown, (a) is a perspective view and (b) is drawing of longitudinal section.
[Drawing 17] Drawing of longitudinal section of an important section showing the 4th example of the structure of holding uniformly the gate electrode of the ion write head and the distance of latent-image support concerning this invention
[Drawing 18] Drawing of longitudinal section of an important section showing the 5th example of the structure of holding uniformly the gate electrode of the ion write head and the distance of latent-image

support concerning this invention
[Drawing 19] Structural drawing showing the configuration of the important section of the 1st example of a printer using the ion write head concerning this invention
[Drawing 20] Structural drawing showing the configuration of the important section of the 2nd example of a printer using the ion write head concerning this invention
[Drawing 21] Structural drawing showing the configuration of the important section of the 3rd example of a printer using the ion write head concerning this invention
[Drawing 22] It is the explanatory view in which the perspective view in which (a) shows the whole configuration, drawing of longitudinal section in which (b) shows the configuration of an important section, and (c) show the arrangement condition of a line electrode and a finger electrode by showing an example of the conventional ion write head.
[Drawing 23] The mimetic diagram showing other examples of the conventional ion write head
[Description of Notations]
16, 16a, 16b, 16A Ion write head
17 Substrate
18 Heat Insulating Layer
19 Heater Layer
21, 21a, an individual electrode
22 Electron Emission Section
23 Conductive Layer
24 24a Heating unit
25 Opening
26, 26a, 26A Gate electrode
27 Insulating Layer
31, 31a, 31b Actuation circuit
42, a heating individual electrode layer

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[Translation done.]

* NOTICES *



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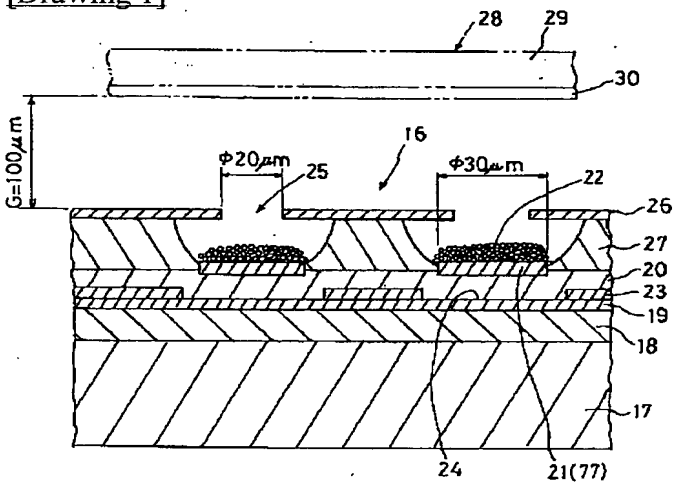
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

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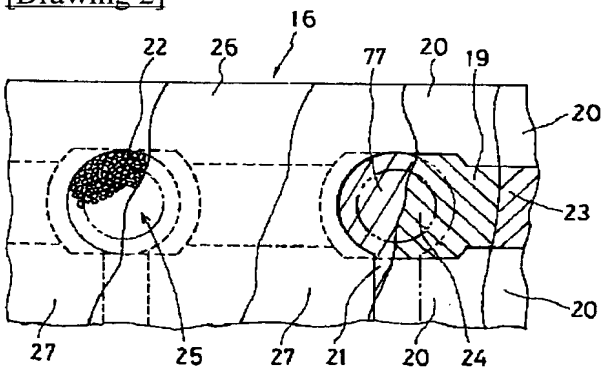


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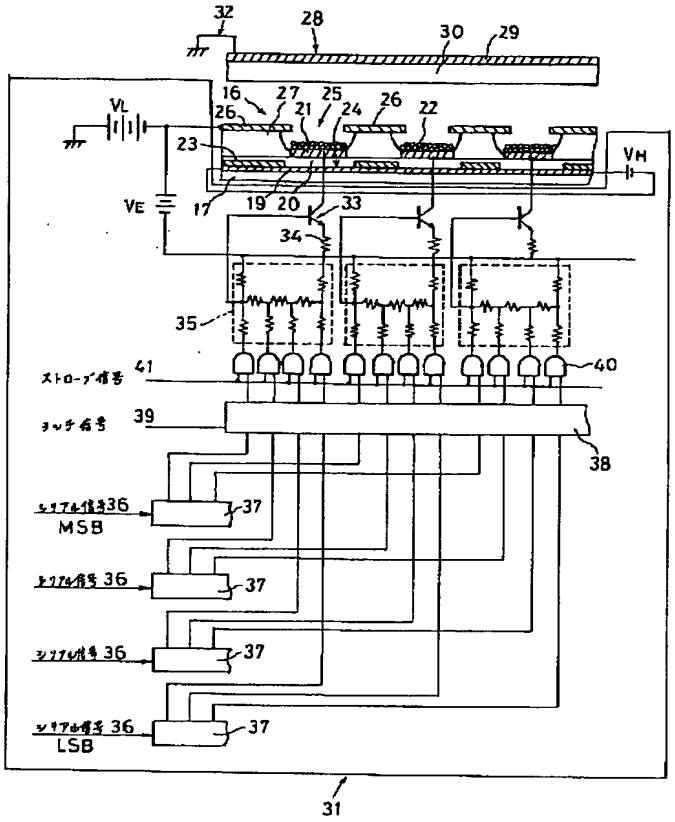
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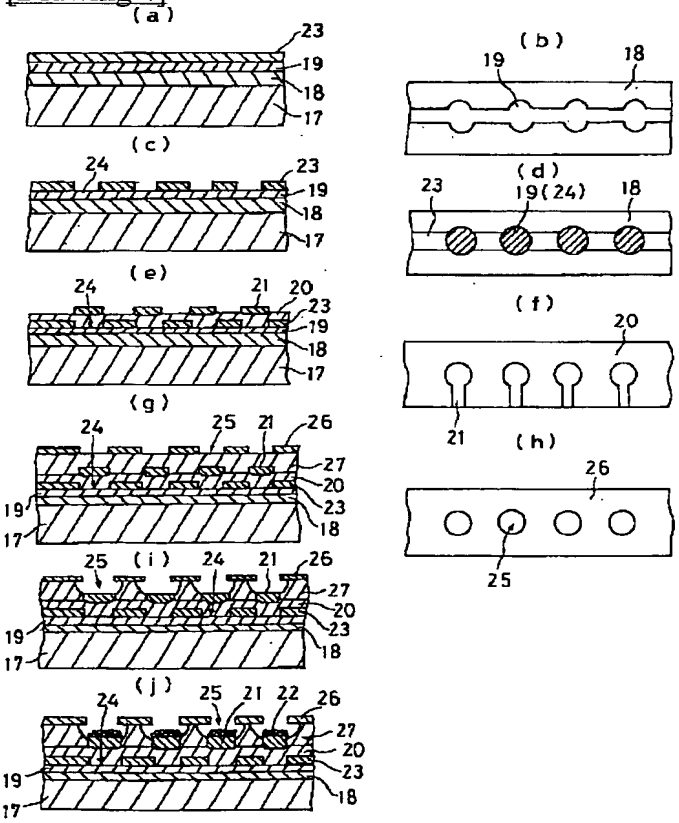
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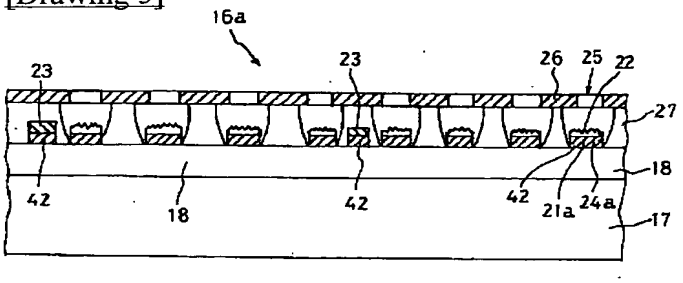


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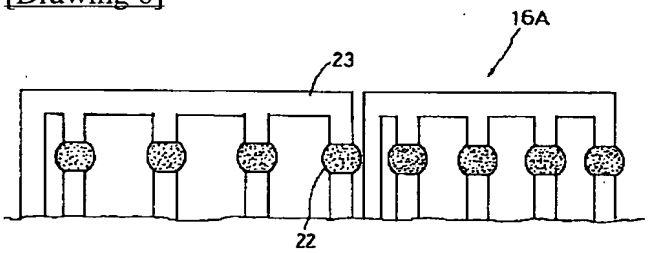


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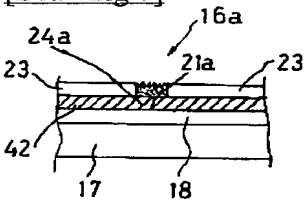


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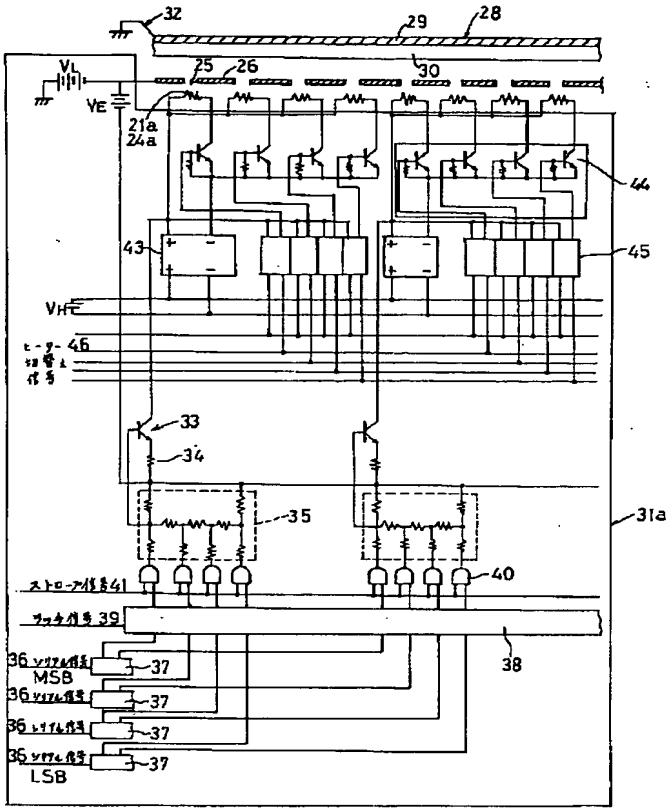


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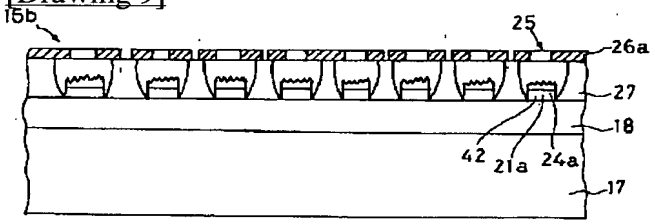


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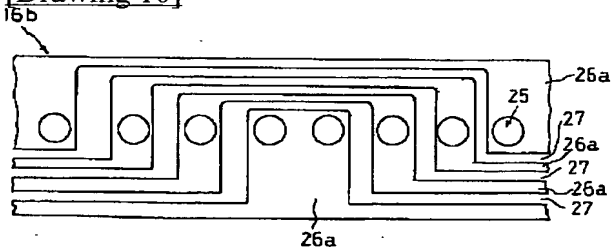


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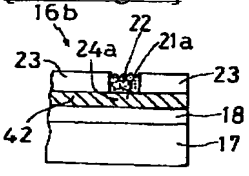


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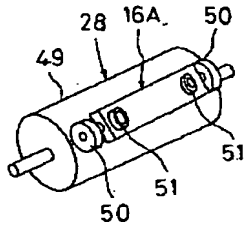


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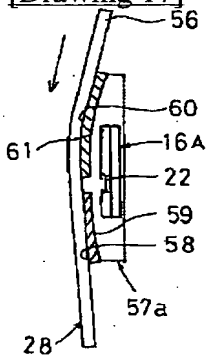


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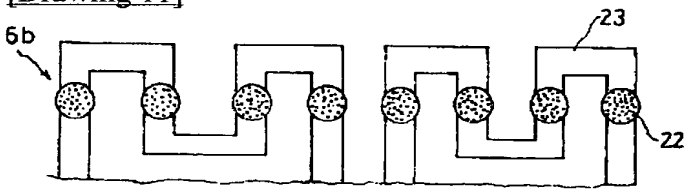


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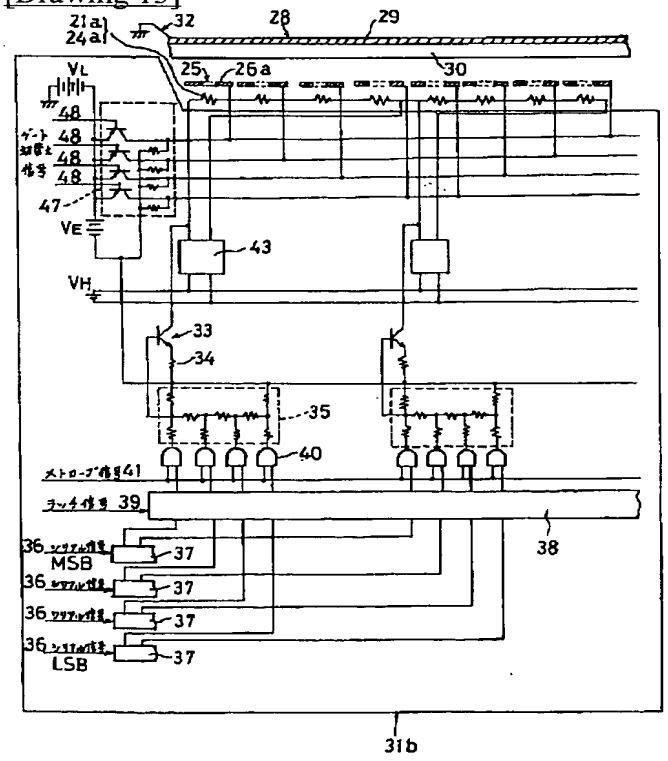

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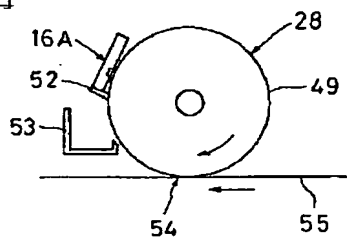


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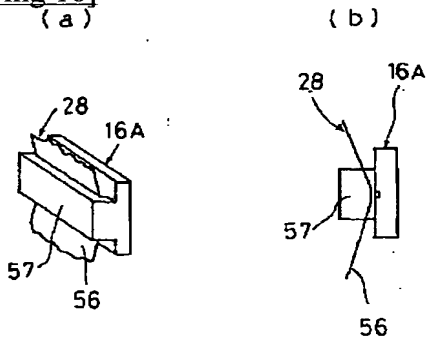


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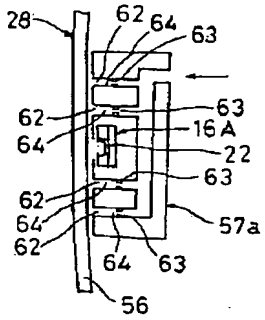


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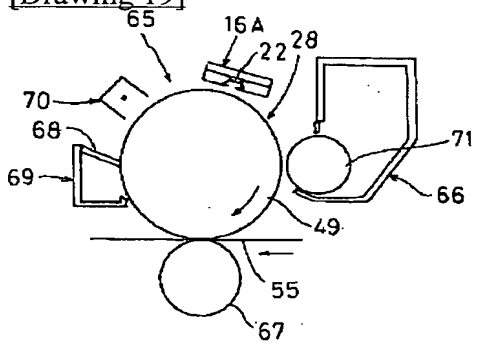


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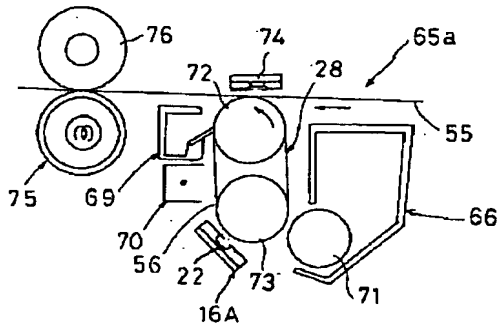


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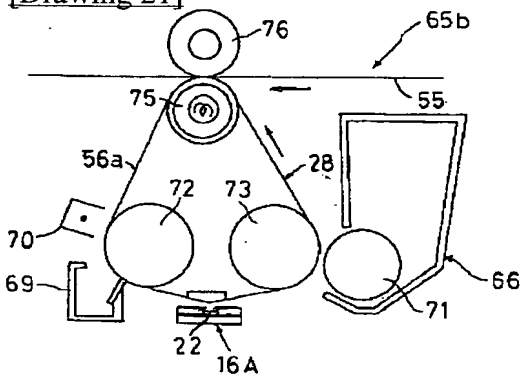


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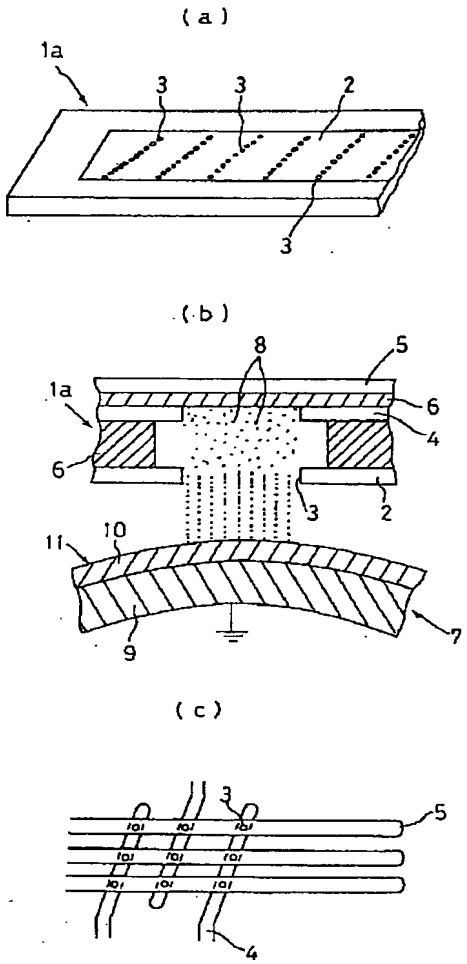


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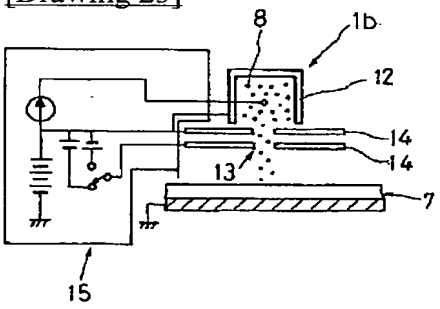


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[Translation done.]

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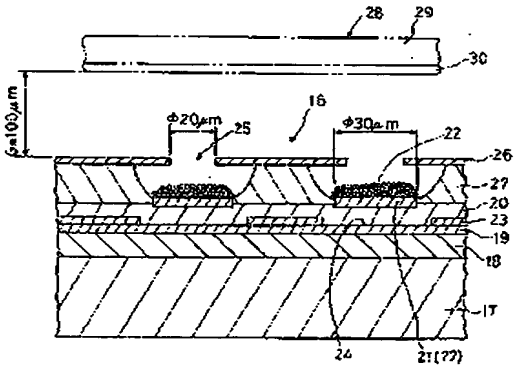
(54)【発明の名称】　イオン書込みヘッド

(57)【要約】

【目的】　小型で、イオンの利用効率の高いイオン書き込みヘッドを提供すること。

【構成】　誘電体により構成される潜像担持体２８上に荷電粒子を選択的に付着させて静電潜像を形成するイオン書き込みヘッド１６であって、基板１７上に形成された複数の個別電極２１と、前記個別電極２１上に形成され加熱されることにより荷電粒子を生成するための電子を放出し得る電子放出部２２と、前記電子放出部２２を加熱するための加熱部２４と、前記個別電極２１と協働して前記電子放出部２２から放出された電子を加速するためのゲート電極２６とを有することを特徴としている。



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【特許請求の範囲】

【請求項１】　誘電体により構成される潜像担持体上に荷電粒子を選択的に付着させて静電潜像を形成するイオン書込みヘッドであって．基板上に形成された複数の個別電極と、前記個別電極上に形成され加熱されることにより荷電粒子を生成するための電子を放出し得る電子放出部と、前記電子放出部を加熱するための加熱部と、前記個別電極と協働して前記電子放出部から放出された電子を加速するためのゲート電極とを有することを特徴とするイオン書込みヘッド．

【請求項２】　前記個別電極が前記加熱部を兼用することを特徴とする請求項１に記載のイオン書込みヘッド。

【請求項３】　前記電子放出部が強誘電体を主体として形成されていることを特徴とする請求項１または請求項２に記載のイオン書込みヘッド。

【請求項４】　前記加熱部を所定のタイミングで発熱させる駆動回路を有することを特徴とする請求項１乃至請求項３の何れか１項に記載のイオン書込みヘッド。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、誘電体により構成される潜像担持体上に外部から画像に対応した荷電粒子を選択的に付着させて静電潜像を形成する静電記録装置等に好適なイオン書込みヘッドに関する。

【０００２】

【従来の技術】近年、従来の電子写真方式において潜像担持体として用いられている感光体と比較して．潜像担持体の機械的な強度が高く．温度や繰り返しに対する安定性も優れている誘電体により形成される潜像担持体を用いるとともに．従来の光に代わって荷電粒子（イオン）を用いて静電潜像の形成を行なうイオン書込み式の印字装置が、高速で印字枚数が非常に多く、メンテナンスの頻度の少ない業務用高速印字装置等に多用されている。そして、イオン書込み式の印字装置は、感光体を用いた電子写真方式の印字装置と比較して潜像電位の制御が容易なため．トナー等の現像剤の付着量を制御することにより濃度階調を有する印字に適しており、濃度階調の再現性が重視されるフルカラーの印字装置等に適している。

【０００３】以下、このような従来のイオン書込みヘッドについて説明する。

【０００４】図２２は従来のイオン書込みヘッドの一例を示すものであり、（ａ）は全体の形状を示す斜視図であり．（ｂ）は要部の構成を示す縦断面図であり．（ｃ）はライン電極とフィンガー電極との配置状態を示す説明図である。

【０００５】図２２の（ａ）に示すように、従来のイオン書込みヘッド１ａは、一方の表面にスクリーン電極２が設けられ、その表面に複数の開口３が鋸歯状に配列して形成されており、全体として略平板状とされている。

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そして、図２２の（ｂ）に示すように．スクリーン電極２と．開口３を持つフィンガー電極４と、ライン電極５とがそれぞれ所望の誘電体からなる絶縁層６を介して配設されている。また、図２２の（ｃ）に示すように、フィンガー電極４の開口３とライン電極５とは、マトリックス状に配置されている。そして、図２２の（ｂ）に示すように、イオン書込みヘッド１ａは各開口３を潜像担持体７に対向するようにして配設されている。

【０００６】このような従来のイオン書込みヘッド１ａにおいては、フィンガー電極４とライン電極５との間に．図示しない所望の駆動回路により．例えば．周波数１ＭＨｚ、電圧１ｋＶ程度の高周波電圧を印加し．フィンガー電極４の周辺の大気中に放電による荷電粒子としてのイオン８（図２２の（ｂ））を発生させるようになっている。また．図２２の（ｃ）に示すように．ライン電極５は複数個設けられており、順次その中の一つに高周波電圧が印加されるようになっている。そして．スクリーン電極２には、－６００Ｖの直流電圧が印加され、フィンガー電極４には待機時に－７００Ｖ、印字時に－４００Ｖの電圧が印加されるようになっている。さらに．印字時のパルス幅は．例えば、２０μＳ程度とされ．フィンガー電極４の周辺の大気中に発生した．例えば．マイナスの極性のイオン８をスクリーン電極２により制御し、図２２の（ｂ）に示すように、開口３を通して潜像担持体７に衝突させるようになっている。

【０００７】前記潜像担持体７は、図２２の（ｂ）に示すように、金属ドラム９の表面に所望の誘電体層１０が形成されたいわゆる誘電体ドラム１１とされ、前記金属ドラム９は接地されている。そして．前述したように、荷電粒子としてのマイナスの極性のイオン８を誘電体ドラム１１の表面に衝突させることにより、図示しない所望の画像に対応した静電潜像を誘電体ドラム１１の表面に形成するようになっている。

【０００８】図２３は他の例の従来のイオン書込みヘッド１ｂを示すものであり．この従来のイオン書込みヘッド１ｂにおいては、荷電粒子としてのイオン８の発生にコロトロン１２を用いており、その前面に所望の複数の開口１３を有する二枚の制御電極１４．１４が配置され．適宜な駆動回路１５により駆動されるようになっている。そして．二枚の制御電極１４．１４の間に加える電圧の極性により、コロトロン１２にて発生させたイオン８．例えば．プラス極性のイオン８が開口１３から潜像担持体７へ到達させるか否かを制御するようにされている。また、二枚の制御電極１４，１４の間の距離は、例えば、１００μｍ程度とされ、開口１３の直径は２００μｍ程度とされている。さらに、イオン書込みヘッド１ｂの解像度は８ドット／ｍｍ程度とされている。また．前記開口１３は、前述した図２２の（ａ）に示すヘッド１ａの開口３と同様に鋸歯状に配列されている。

【０００９】

【発明が解決しようとする課題】しかしながら．前述した従来のイオン書込みヘッド１（符号は従来のイオン書込みヘッド１ａ．１ｂを総称する）においては．潜像形成に必要な量だけのイオン８をリアルタイムにて発生させることが不可能なため．常時多量のイオン８を発生させ．その一部をスクリーン電極２あるいは二枚の制御電極１４，１４等により潜像担持体７上に導いて静電潜像を形成するようにされている。このため、発生させたイオン８の利用効率が低く．イオン８と同時に発生するオゾンの処理や．消費電力の増大、ヘッド１の大型化、高電圧を制御する制御電極用の駆動回路１５の大型化や高価格化等という種々の問題点があった。

【００１０】また、従来のイオン書込みヘッド１においては．イオン８が通過する開口３，１３の大きさの下限に制約があるという問題点があった。この制約の一つは発生したイオン８の利用効率を大きくするためであり、もう一つは高電圧を印加するスクリーン電極２または制御電極１４の加工精度と絶縁耐圧を保持させなければならないということである。

【００１１】つまり、大きな開口３．１３を有するスクリーン電極２または制御電極１４を用いることの問題点は．制御電圧の絶対値が大きくなる点と、イオン書込みヘッド１から潜像担持体７に向かって流れるイオン８（イオン流）を絞った場合に形成される静電潜像の１ドットの直径が十分に小さくならないという点である。イオン流を絞る場合には、電極２，１４に加わる電圧のためにイオン流の直径は制御電極２，１４の開口３．１３の直径の数分の一程度に集束される。このため．形成される静電潜像の１ドットの直径はイオン流を増やした場合に比べて小さくなる。しかし、集束率の限界のためイオン流を絞った場合の静電潜像の電位は中間的な値となり．電位により中間調を再現することになる。

【００１２】また、トナーの付着量により濃度階調を再現する場合に．面積階調の場合の再現性は良いが．濃度階調の場合の再現性はトナーの帯電量のばらつき等の要因により再現性があまりよくない。一般に、従来のイオン書込みヘッド１は、他の書込み方式に比べて濃度階調の再現性が優れていると言われている。この再現性について厳密にみると、イオン８の流量が多く面積階調の領域に入る場合の階調の再現性や安定性は優れているが、イオン８の流量を絞った場合の階調再現性は高濃度領域に比べると劣っている。そして、静電潜像の面積は変わらず電位の変化により階調の再現を行なう場合には、静電潜像の形成が入力信号に対して正確に行なわれても現像工程でトナーの付着量のばらつきなどの画像の品位を劣化させる要因が多く、結果的に面積階調における階調再現性よりも劣ったものにならざるを得ない。

【００１３】前記開口３．１３の大きさを小さくできないことは、解像度を上げられないことと、開口３．１３を一直線上に並べられないなどの設計上の制約という問



題点を有している。

【００１４】一般に、電子写真方式の印字装置においても．白と黒の二値画像の再現性に対しては一定レベルの印字品質を得ることができるが、中間調を含む画像の再現性は良くない。そこで．現在の電子写真方式においては．ディザを用いた面積階調によって疑似的に中間調を再現する方法が主流になっており、ディザを用いた場合の印字の解像度は、静電潜像形成手段における解像度に比べて大幅に低下する。

【００１５】代表的なディザのマトリクスは４×４画素や６×６画素程度で形成される。その場合の階調再現性は１６段階および３６段階になり、形成される画像の解像度は１／４または１／６となる。階調再現性を重視する場合に、実用的な解像度を得るためには非常に解像度の高い静電潜像を形成する必要がある。

【００１６】従来のイオン書込みヘッド１を用いた印字装置においては．中間調の再現性が優れているため、ディザに頼らないでも濃度階調の再現が可能である。そのため開口３，１３の大きさの制限等のため解像度を上げられないという問題点を濃度階調の再現性で補うことができると考えられてきた。つまり、写真のような階調再現性が優先される用途においては、解像度は低くても階調再現性が優れていれば再現性を補うことができるが、文字の印字等の高い解像度が要求される用途においては．階調再現性を利用して多少の改善は行なえるとしても．高い解像度を持つ電子写真方式に対して大幅に劣った印字品質しか得られないという問題点があった。

【００１７】また、従来のイオン書込みヘッド１においては．複数の開口３，１３を印字幅方向に一直線に形成することができず、斜めに複数の開口３，１３を並べ、時分割にて一つのラインの静電潜像を形成する方式が用いられており．潜像担持体７に速度のムラがあったり、書込みのタイミングがずれたりすると．静電潜像の位置がずれて印字品質が大幅に低下するという問題点があった。また、画像の並べかえやタイミングの発生等で、図示しない制御回路および駆動回路１５などが複雑で高価なものになりやすく、しかも、イオン書込みヘッド１自体が大型化し．イオン書込みヘッド１と潜像担持体７との間の距離を一定に保つことが難しくなるという問題点があった。

【００１８】本発明はこれらの点に鑑みてなされたものであり、前述した従来のものにおける問題点を克服し、小型で、イオンの利用効率の高いイオン書込みヘッドを提供することを目的とする。

【００１９】

【課題を解決するための手段】前述した目的を達成するため請求項１に記載の本発明のイオン書込みヘッドは、誘電体により構成される潜像担持体上に荷電粒子を選択的に付着させて静電潜像を形成するイオン書込みヘッドであって、基板上に形成された複数の個別電極と．前記

個別電極上に形成され加熱されることにより荷電粒子を生成するための電子を放出し得る電子放出部と、前記電子放出部を加熱するための加熱部と、前記個別電極と協働して前記電子放出部から放出された電子を加速するためのゲート電極とを有することを特徴としている。

【００２０】そして、請求項２に記載の本発明のイオン書込みヘッドは、請求項１において、前記個別電極が前記加熱部を兼用することを特徴としている。

【００２１】さらに、請求項３に記載の本発明のイオン書込みヘッドは、請求項１又は請求項２において、前記電子放出部が強誘電体を主体として形成されていることを特徴としている。

【００２２】また、請求項４に記載の本発明のイオン書込みヘッドは、請求項１乃至請求項３の何れか１項において、前記加熱部を所定のタイミングで発熱させる駆動回路を有することを特徴としている。

【００２３】

【作用】前述した構成からなる本発明のイオン書込みヘッドは、いわゆる熱電子放出の原理を用いてイオンを発生させるものであり、基板上に形成した加熱部を加熱することにより、電子放出部を加熱してここから熱電子を放出させ、この電子をゲート電極と個別電極との間に印加されている電界により加速してイオンを生成し、このイオンを個別電極と潜像担持体との間に印加されている電界により潜像担持体の表面に移動させて潜像担持体の表面に静電潜像を形成することができる。

【００２４】

【実施例】以下、本発明を図面に示す実施例により説明する。

【００２５】図１から図３は本発明に係るイオン書込みヘッドの第１実施例を示すものであり、図１は要部の構成を示す縦断面図であり、図２は要部の構成を示す一部切断平面図であり、図３は駆動回路を示す回路図である。

【００２６】図１および図２に示すように、本実施例のイオン書込みヘッド１６は、基板１７上に熱絶縁層１８が配設されており、この熱絶縁層１８の上面には、ヒータ層１９が配設されている。そして、ヒーター層１９の上面には、中間絶縁層２０を介して分解能（画素数）に対応した複数のカソード電極と称される、例えば、直径３０μｍ程度の基部７７を有する個別電極２１が図において左右方向（印字幅方向）に一列状に整列配置されている。さらに、各個別電極２１の基部７７の上面には、荷電粒子（イオン）を生成するための電子を放出し得る電子放出部２２が配設されている。また、ヒータ層１９の上面には、ヒータ層１９の発熱を各電子放出部２２に対して集中させるための導電層２３が各電子放出部２２に対向する部位を除いて配設されている。つまり、本実施例においては、ヒータ層１９の各電子放出部２２に対応する導電層２３に覆われていない部位が、各電子放出部２２を加熱するための加熱部２４とされている。さらにまた、基板１７上には、各電子放出部２２を中心とした、例えば、直径２０μｍ程度の円形の開口２５を有するゲート電極２６が適宜な厚みの絶縁層２７を介して配設され、全体として略平板状に形成されている。



【００２７】前記基板１７の素材としては、耐熱性が高く、必要な機械強度と加工性を持つもので有ればよく、アルミナセラミック、ガラス等の絶縁物や表面をＳｉＯ２等の絶縁物で被覆したシリコン基板等の種々のものを選択することができる。

【００２８】前記熱絶縁層１８の素材としては、熱伝導率の小さい高融点ガラス、発泡ガラス、ジルコニアセラミック、二酸化ケイ素等の種々のものを選択することができる。

【００２９】前記ヒータ層１９の素材としては、タングステン、ニクロム、窒化タンタル等の種々のものを選択することができる。

【００３０】前記中間絶縁層２０の素材としては、大きな電界が加わり発生したイオンに曝されるため、絶縁性能および安定性が高い、ＳｉＯ２、Ａｌ２Ｏ３等の無機物の絶縁物を用いることが望ましい。

【００３１】前記個別電極２１の素材としては、導電性と加工性を考慮し、白金、タングステン、タンタル、モリブデン等の金属素材を用いることが望ましい。

【００３２】前記電子放出部２２の素材としては、加熱により電子を放出する熱電子放出作用を有する強誘電体、例えば、チタン酸バリウム、チタン酸ストロンチウム、ジルコン酸バリウム、ジルコン酸ストロンチウムなどを例示することができ、これらを必要に応じて単独あるいは組み合わせて用いることができる。

【００３３】前記導電層２３の素材としては、ヒータ層１９より小さな電導率を有し耐熱性に高い白金、タンタル、タングステン、モリブデン等が望ましい。

【００３４】前記ゲート電極２６の素材としては、モリブデン、タンタル等の種々のものを選択することができる。

【００３５】前記絶縁層２７の素材としては、大きな電界が加わり発生したイオンに曝されるとともに熱が加わるので、熱損失が少なく絶縁性能および安定性が高い、透明あるいは白色のＳｉＯ２、Ａｌ２Ｏ３等の無機物の絶縁物を用いることが望ましい。

【００３６】また、図１に想像線にて示すように、前記イオン書込みヘッド１６のゲート電極２６に対向するようにして静電潜像が形成される潜像担持体２８が配設されるようになっており、この潜像担持体２８は、所望の金属基体２９の表面に適宜な誘電体層３０が形成されるとともに、前記ゲート電極２６から１００μｍ程度の一定の距離Ｇ（ギャップ）を隔てて配設され、前記各電子放出部２２が配置されている主走査方向に対して直交する副走査方向に一定速度をもって移動自在にされてい

る。

【００３７】図３に示すように、本実施例のイオン書込みヘッド１６の駆動回路３１は、潜像担持体２８のイオン書込みヘッド１６に対して反対側に設けられた金属基体２９を背面電極３２として接地することにより基準電位が形成されている。この駆動回路３１は、ゲート電極２６に対してマイナスの極性の電圧を供給する潜像書込み用電源ＶＬが電気的に接続されるとともに、ゲート電極２６は、各個別電極２１に対する共通電極とされている。そして、各個別電極２１は、それぞれ適宜な駆動トランジスタ３３に接続されるとともに、各駆動トランジスタ３３はゲート電極２６を基準電位とし、ゲート電極２６に対してマイナスの極性の電圧を印加する電子加速用電源ＶＥに電流設定抵抗３４を介して接続されている。また、ヒータ層１９には、加熱部２４の発熱温度を常に一定の温度に制御するための図示しない温度制御部を介して加熱用電源ＶＨが電気的に接続されている。なお、ヒータ層１９に対する加熱用電源ＶＨの通電は、制御指令に基づいて、各画素の静電潜像の形成に同期したパルス電圧により制御することが好ましい。

【００３８】前記駆動回路３１について更に説明すると、本実施例の駆動回路３１は、定電流回路により構成されており、この定電流回路の電流は、各駆動トランジスタ３３のエミッタに接続された電流設定抵抗３４と、各駆動トランジスタ３３のベースに加えられる電圧によって決定される。そして、各駆動トランジスタ３３のベース電圧は、抵抗を梯子型に組み合わせたＤ／Ａ変換回路３５を介して重み付けされたディジタル信号を入力することにより印加される。さらに、イオン書込みヘッド１６に対する入力信号は、各々が別の重みを持つシリアル信号３６とされ、各々のシリアル信号３６に対応するシフトレジスタ３７によりパラレル信号に変換される。また、このパラレル信号は、一旦ラッチ３８に保持された後、ラッチ信号３９により、ゲート回路４０に出力され、ゲート回路４０によりストローブ信号４１とのアンドを取りＤ／Ａ変換回路３５に入力される。このストローブ信号４１は、個別電極２１のゲート電極２６に対する動作時間を決定する信号である。

【００３９】すなわち、本実施例における各個別電極２１は、個々に絶縁されて定電流特性を有する駆動回路に電気的に接続されており、ヒータ層１９は、各加熱部２４を直列に接続している。

【００４０】なお、ヒータ層１９を分割して複数のグループにする構成とすることにより電力を削減することができる。

【００４１】つぎに、本実施例のイオン書込みヘッド１の製造工程について、図４の（ａ）から（ｊ）により説明する。

【００４２】まず、ガラス等の絶縁物からなる略平板状の適宜な基板１７の上面に、二酸化ケイ素からなる熱絶



縁層１８と、窒化タンタルからなるヒータ層１９と、タンタルからなる導電層２３とを公知の薄膜形成方法を用いて順次成膜する。そして、ヒータ層１９および導電層２３の所定の位置をエッチング等により同一形状に除去して、図４の（ａ）および（ｂ）に示すように、ヒータ層１９および導電層２３を所定の形状に形成する。ついで、導電層２３の所定の位置をエッチング等により除去して、図４の（ｃ）および（ｄ）に示すように、ヒータ層１９の所定の部位を露出させ、画素数に対応した所定の数の加熱部２４を形成する。つぎに、$SiO_2$からなる中間絶縁層２０を公知の薄膜形成方法を用いて同様にして成膜した後に、図４の（ｅ）および（ｆ）に示すように、タンタル等の金属からなる個別電極２１を公知の薄膜形成方法およびエッチングを用いて画素数に対応した所定の数だけ形成する。つぎに、$SiO_2$からなる絶縁層２７と、タンタル等の金属からなるゲート電極２６とを順次同様にして成膜した後、図４の（ｇ）および（ｈ）に示すように、ゲート電極２６の所定の位置をエッチング等により除去して、所望の大きさの開口２５を形成する。ついで、絶縁層２７の所定の位置をエッチング等により除去して、図４の（ｉ）に示すように、開口２５の下方に位置する個別電極２１を露出させる。つぎに、個別電極２１上に強誘電体を含有する電着液を泳動電着させて電着膜を成膜することにより電子放出部２２を形成し、イオン書込みヘッドの製造が完成する。なお、電子放出部２２を形成する場合には、電子放出部２２を形成する前工程にてゲート電極２６上にフォトレジスト等により適宜な離型層（図示せず）を形成しておき、電子放出部２６を形成した後に離型層を除去するとよい。

【００４３】つぎに、本実施例のイオン書込みヘッド１６の電子放出部２２の形成について更に詳しく説明する。

【００４４】本実施例の電子放出部２２を形成するには、まず、強誘電体を主成分とする電着液を形成する。この電着液は、チタン酸バリウム等のペロブスカイト型の強誘電体粉末を湿式粉砕によって粒径１μｍ以下程度に粉砕し、純水にて洗浄して水酸化バリウム等の不純物を除去する。つぎに、メタノールに電解質としての純水１％（ｗｔ％）、塩化カルシウム０．００１２％（ｗｔ％）を加えて電解液を形成する。つぎに、前記電解液に強誘電体化合物の粉末を０．１５％加えることにより電着液を形成する。この電着液のＰＨは７弱、導電率は３０μＳ／ｃｍ程度である。このとき、強誘電体化合物自体は、化学的に安定で水への溶解度が小さいが、未反応のバリウムおよびチタン等の酸化物は水と反応して水酸化物となって水に溶解し、電着液の抵抗率を低下させるため予め取り除く必要がある。また、電解液中の塩化カルシウムは、電着液中でカルシウムイオンと塩素イオンとに電離し、形成される電着膜中に水酸化カルシウムと

して取り込まれる。ついで、電着液を撹拌した後、数時間静置することにより、粒径の大きい強誘電体化合物を沈降させて除去し、電着液の製造が完了する。

【００４５】つぎに、イオン書込みヘッド１６の個別電極２１を陰極とし、陽極にイオン化しにくい白金を用いて５０Ｖ程度の電圧を加えて泳動電着を行うことにより、各個別電極２１上に電着膜が成膜される。この泳動電着時の電流密度は７０ｍＡ／ｃｍ$^2$程度、電着速度は１μｍ／ｍｉｎ程度とするとよい。

【００４６】つぎに、大気中において２００～３００℃程度で数時間加熱する熱処理を施してメタノールを除去しその後６００℃程度の温度で大気中あるいは真空中にて数時間加熱することにより、各個別電極２１上に電子放出部２２が形成される。なお、電着膜中に取り込まれた水酸化カルシウムは、熱処理によって一部が大気中の二酸化炭素と反応して炭酸カルシウムとなり、残りは酸化カルシウムとなり、これらのカルシウム化合物は、強誘電体（強誘電体化合物）の粉体の間を固めるセメントの役目をし、各個別電極２１上に形成された電子放出部２２となる電着膜を強固なものとする。

【００４７】つぎに、本実施例のイオン書込みヘッド１６を真空槽に入れ、電子放出部２２を加熱して電子放出量（エミッション）を評価した。加熱温度を徐々に高くし、エミッションが微小電流領域から増加する過程を記録した。各々の温度に対するエミッションは、一般的なバリウムやカルシウムの酸化物被覆型の熱電子放出素材と同様のレベルであり、仕事関数がほぼ等しいことが確認できた。また、その温度で数時間動作させた場合に、特性が安定していることが確認できた。

【００４８】ついで、真空槽の圧力を真空状態から大気圧状態に向かって徐々に高くし、最終的に大気圧中での特性を評価したところ、個別電極２１とゲート電極２６との間の電界を大きくすることにより、電子放出部２２から電子を効率的に放出できることが判明した。そして、電子放出部２２から取り出せる電流は、個別電極２１とゲート電極２６との間の電界に比例し、その間の距離に反比例する関係にあるとともに、大気中において取り出せる電流は、真空中における場合に比較して１／１００から１／１０００程度であることが判明した。

【００４９】つぎに、前述したイオン書込みヘッド１６の作用について説明する。

【００５０】本実施例のイオン書込みヘッド１６を駆動させ、ヒータ層１９に加熱用電源ＶＨの電流を通電すると、ヒータ層１９に形成された加熱部２４が発熱し、この加熱部２４の発熱は、個別電極２１および電子放出部２２を所定温度に加熱する。そして、加熱された電子放出部２２は、熱電子放出の原理によって電子（熱電子）を電子放出部２２の外側の空間に放出する。

【００５１】前記電子放出部２２の外側の空間へ放出された電子は、個別電極２１とゲート電極２６との間に印加された電子加速用電源ＶＥの電圧により形成される電界によって加速された後、ゲート電極２６と潜像担持体２８との間の空間で酸素分子に捕捉され、酸素イオンとなり荷電粒子としてのマイナスの極性のイオン（図示せず）が生成される。このイオンは、ゲート電極２６と潜像担持体２８の背面電極３２との間に印加されたる潜像書込み用電源ＶＬの電圧により形成される電界によって潜像担持体２８の表面に向かって移動する。



【００５２】また、本実施例のイオン書込みヘッド１６は、従来からある薄膜形成方法およびエッチング等を用いて各個別電極２１を一列状に形成し、その上方に電子放出部２２を電着させることにより形成されており、複雑で微細な構造の各個別電極２１および電子放出部２２を容易に形成することができるとともに、ライン状に形成することができ、イオン書込みヘッド１６の解像度を容易に向上させることができる。

【００５３】つぎに、イオンの生成およびイオンの移動について説明する。

【００５４】本実施例においては、ゲート電極２６と潜像担持体２８との間のギャップＧが１００μｍとされ、ゲート電極２６の電位は潜像担持体２８の背面電極３２に対して－５００～－６００Ｖとされており、ゲート電極２６と潜像担持体２８との間の電界は５～６ＫＶ／ｍｍにされている。この電界の値は、ゲート電極２６と潜像担持体２８との間のギャップＧにおける大気中の火花放電電圧の半分程度の値である。

【００５５】また、電子放出部２２を加熱することにより電子を大気中に放出させた場合に、大気圧の空気中での電子の平均自由行程は約４００ｎｍ、大気中の酸素分子の平均自由行程は６４ｎｍであり、放出された電子は１００μｍのギャップＧの間をドリフトする間に、$10^7$～$10^9$回大気中の気体分子と衝突し、酸素分子や水蒸気の分子に確率的に捕捉されて荷電粒子としてのマイナスの極性のイオン（$O_2^-$イオン）が生成される。このとき、酸素分子に低エネルギーの電子が捕捉される確率は、２×$10^{-1}$程度で、潜像担持体２８の表面には、イオンと電子とが混ざりあった状態でイオン流となって到達して潜像担持体２８の表面にマイナスの極性の電荷を与え、潜像担持体２８の表面にマイナスの極性の微細な静電潜像が形成される。つまり、初期状態（静電潜像が書き込まれる前）の潜像担持体２８の表面電位は除電によって０Ｖとされており、潜像担持体２８の表面に到達したマイナスの極性のイオンから電子を受け取り、その表面にマイナスの極性のイオンの到達量に比例した電位の静電潜像が形成される。このとき、潜像担持体２８の表面に到達するイオンおよび電子は、電気力線に平行に移動するので、静電潜像電位が飽和するまではその広がりを無視することができる。この静電潜像の電位の最大値は、潜像書込み用電源ＶＬの電圧に近い値で飽和する。

【００５６】したがって．静電潜像の電位が飽和した後に潜像担持体２８の表面に到達したマイナスの極性のイオンは、潜像担持体２８の表面に沿って潜像電位の小さい方に移動し．その部分の表面に電荷を与える。すなわち．潜像担持体２８上の静電潜像は同心円状に広がることとなる。この静電潜像の広がりは．ゲート電極２６と潜像担持体２８との間のギャップＧが短いほど少なくなる。

【００５７】前記イオンの質量は、電子の５．９×１０$^{-4}$倍程度であり．前記ゲート電極２６と潜像担持体２８の背面電極３２との間の電界によるイオンの移動速度は１００ｍ／Ｓ程度とされ．１００μｍの前記ギャップＧ間のイオンの移動時間は１μＳ程度となる。

【００５８】ここで、画像形成の解像度を３００ＤＰＩ．潜像担持体２８の移動速度（プロセス速度）を１００ｍｍ／Ｓとすると、一つの画素（ドット）の大きさは約８４．６７μｍ角で、１ラインの書込みに要する時間は８４７μＳとなり、イオンの移動速度は、１ラインの書込み時間より十分に短いので、静電潜像の書込みの障害にはならない。

【００５９】また、電子放出部２２からのエミッションが少ない場合には、ゲート電極２６の電圧は電子放出部２２の電位に対してマイナスとなり．電子放出部２２の周囲の空間の開口２５に近い部分の電位がマイナスとなって．イオンおよび電子からなるイオン流は、ゲート電極２６の開口２５の中心部に収束する。このゲート電極２６の開口２５に対するイオン流の収束率は、最大で３倍程度になる。

【００６０】つまり、潜像担持体２８上に形成される静電潜像の大きさは、潜像担持体２８の表面に到達するマイナスの極性のイオンの量が少ない場合には、電気力線が到達する小さい直径に集中し、到達するイオンの量が増えるにともない静電潜像のマイナスの極性の電位が上昇し．潜像担持体２８の表面に到達する電気力線が広がる。それに連れて到達するマイナスの極性のイオンが潜像担持体２８の表面上に同心円状に広がり静電潜像の面積が拡大することとなる。

【００６１】したがって．発生するイオンの量に対する静電潜像の面積の直線性を極めて高くすることができる。

【００６２】すなわち、静電潜像をトナーにより現像してトナー像とする場合において、トナーの付着量の直線性は．静電潜像の電位が中間調を持つ場合と一定電位の静電潜像の面積が変化する場合とでは．面積階調の方が低い印字濃度領域においても微細な面積の静電潜像を形成することができ、広範囲の面積階調による印字が可能になるので、本実施例のイオン書込みヘッド１６は、従来のイオン書込みヘッド１．１ａに比べて階調の再現性が極めて優れた高品位の印字品質を得ることができる。この印字品質は．文字の印字等の高い解像度が要求される用途に用いられている高い解像度を有する電子写真方式の印字品質に対しても優れている。



【００６３】前記静電潜像の面積の拡大は無制限に起きるわけでなく．ゲート電極２６と潜像担持体２８の背面電極３２との間に印加された電界によって到達するイオンの量に応じた一定の範囲に制限される。また．形成される静電潜像の電位も、ゲート電極２６と潜像担持体２８の背面電極３２との間に印加される電圧に近いほぼ一定の値に制限される。

【００６４】前記ゲート電極２６と潜像担持体２８との間のギャップＧは、トナーの侵入によるショートの危険性や．潜像担持体２８を走行させた場合のゲート電極２６と潜像担持体２８との間のギャップＧの精度により制限されるが、ゲート電極２６と潜像担持体２８との間のギャップＧは．略一定の距離Ｇを常に保持するように構成することが好ましい。

【００６５】なお、大気中に存在するプラスの極性のイオンは、ゲート電極２６と潜像担持体２８との間の電界により、イオン書込みヘッド１６の表面に形成され面積が大きく電位が最もマイナスとなるゲート電極２６の表面に衝突するので、電子放出部２２をスパッタし消耗させる確率は極めて小さく．電子放出部２２は、長期間に亘り安定した機能を保持することができる。

【００６６】また、イオンが移動する速度は電界の大きさに比例するため、絶縁破壊しない範囲内で高い電界とすることが好ましい。

【００６７】つぎに、静電潜像形成に必要な電流について説明する。

【００６８】前記潜像担持体２８の表面に形成される静電潜像の電位は．潜像担持体２８に到達するイオンまたは電子の電荷と潜像担持体２８の誘電体層３０の静電容量の比率で決まる。ここで．潜像担持体２８の誘電体層３０の膜厚を２０μｍ、その誘電率を２．５とすると、１ｃｍ$^{2}$当たりの静電容量は１１０．７ｐＦとなる。この潜像担持体２８の誘電体層３０を０Ｖから－５００Ｖまで帯電させるのに要する電荷は５５．３５ｎＣである。潜像担持体２８の画像記録の幅を２１０ｍｍ．プロセス速度を１００ｍｍ／ｓとすると．イオン書込みヘッド１６全体で必要な電流は１１．６２μＡである。印字部の長さを２１０ｍｍとした場合の画素数は、３００ＤＰＩで２４８０個、４００ＤＰＩで３３０７個となり、各個別電極２１当たりの平均電流は３００ＤＰＩで４．６９ｎＡ、４００ＤＰＩで３．５１ｎＡとなる。

【００６９】前記個別電極２１の大きさを直径３０μｍとすると、その面積は７．０７×１０$^{-6}$ｃｍ$^{2}$で．電流密度は、３００ＤＰＩで６６３μＡ／ｃｍ$^{2}$、４００ＤＰＩで４９７μＡ／ｃｍ$^{2}$となる。そして、電流密度の点では、個別電極２１を真空中で動作させる場合の１００ｍＡ／ｃｍ$^{2}$よりもかなり小さいが．イオンまたは電子が大気中で散乱されて移動度が低下することを考慮に

いれると同等のレベルである。この個別電極２１の大きさは、電流密度と、加工技術による寸法精度によって制限される。

【００７０】つぎに、液体現象を用いた場合の階調再現性について説明する。

【００７１】液体現象を用いた場合の階調再現性は、イオン書込みヘッド１６の解像度が決定要因となる。本実施例におけるイオン書込みヘッド１６は、個別電極２１の直径が３０μｍ、ゲート電極２６の直径が２０μｍとされており、静電潜像の大きさの下限は７μｍとなり、静電潜像の大きさの上限は、３００ＤＰｉで８４．６７μｍ角、４００ＤＰｉで６３．５μｍ角となる。そして、静電潜像の直径が７μｍの場合のドット面積は３８．５μｍ$^2$となり、各々の解像度の１画素の面積は、３００ＤＰｉで７０６９μｍ$^2$、４００ＤＰｉで４０３２μｍ$^2$となり、面積比は、３００ＤＰｉで１８３．６倍、４００ＤＰｉで１０４．７倍となり、ディザ無しで概略１２８階調（７ビット）程度とすることができる。さらに、２～４画素単位のディザにより各色２５６階調（８ビット）１６７万色の表示が可能である。

【００７２】つぎに、乾式現像を用いたの場合の階調再現性について説明する。

【００７３】乾式現象を用いた場合の階調再現性は、トナーの粒径が決定要因となる。現在の粉砕法による高画像度トナーの代表的な粒径は、７μｍ程度であり、静電潜像の大きさの下限は１４μｍ程度とされている。この場合のドット面積は１５３．９μｍ$^2$で、静電潜像の面積比は、３００ＤＰｉで４５．９倍、４００ＤＰｉで２６．２倍となり、静電潜像の大きさの直線性が高いため、各画素の印字濃度が上記の面積比で決定される最低値より大きい場合には、ディザの処理は不要となる。また、印字濃度が上記の面積比の最低値より小さい場合には、各色８ビットの階調再現を得るためには、３×３の９ドットや、４×４の１６ドット単位のマトリクスのディザを用いるとよい。

【００７４】つぎに、イオン書込みにおける解像度について説明する。

【００７５】本実施例のイオン書込みヘッド１６を用いた印字装置によれば、三原色に各々８ビット（２５６階調）合計１６７万色が殆どディザを用いないで再現でき、画像の解像度は写真や昇華型に近いレベルとすることができる。

【００７６】カラーのビットマップの画像の場合、情報量の制限のために大部分のデータの画素はイオン書込みヘッド１６によって構成される画像の画素数よりも少なく、ソフトウェアにより拡大して印字することになる。代表的な画素数として横６４０ドット、縦４８０ドット、２４ビット（１６７万色）の情報量はデータを圧縮しない場合９００ｋバイトとなる。その画像を横８ｃｍ、縦６ｃｍの大きさで印字する場合の解像度は８ドット／ｍｍ（約２００ＤＰＩ）となる。解像度が通常のページプリンタと同じ３００～４００ＤＰｉあれば、特別に解像度が高い画像の印字を行なう場合以外は忠実な再現性を得ることが可能である。



【００７７】また、本実施例のイオン書込みヘッド１６を用いた印字装置によれば、濃度階調の再現性において電子写真方式等に対し圧倒的に優れているが、階調のない文字の印字においては印字ヘッドの解像度が画質を決定する要因となる。印字ヘッドとしてのラインヘッドの画素が並ぶ方向（主走査方向）の解像度は、印字ヘッドの解像度により決まるが、本実施例のイオン書込みヘッド１６における画素の数となる個別電極２１の数は、潜像担持体２８または印字媒体が移動する方向（副走査方向）に対して細分化（増加）させることが容易であり、文字の印字の場合、イオン書込みヘッド１６における個別電極２１の数を増加させ解像度を高くすることにより、印字した文字の縁のぎざぎざを円滑にすることができる。

【００７８】したがって、高電圧を用いたコロナ放電や高周波放電による従来のイオン書込みヘッド１．１ａと異なり、本実施例のイオン書込みヘッド１６は、静電潜像形成に必要な量だけのイオンをリアルタイムに発生させることができるとともに、駆動回路３１の集積化が容易になり、確実に小型化、低価格化することができるとともに、解像度を確実に向上させることができる。

【００７９】図５から図８は本発明に係るイオン書込みヘッドの第２実施例を示すものであり、図５は要部の構成を示す縦断面図であり、図６はゲート電極と絶縁層を省いた平面図であり、図７は図６の側断面図であり、図８は駆動回路を示す回路図である。

【００８０】本実施例のイオン書込みヘッド１６ａは、前記第１実施例の個別電極２１がヒータ層１９の機能を兼ねるとともに、個別電極２１をグループ化した構成としたものである。

【００８１】図５に示すように、本実施例のイオン書込みヘッド１６ａは、基板１７上に熱絶縁層１８が配設されており、この熱絶縁層１８の上面には、前述した第１実施例のヒータ層１９および個別電極２１を兼用するための所定の形状の加熱個別電極層４２が配設されている。そして、加熱個別電極層４２の上面には、導電層２３が配設されている。さらに、加熱個別電極層４２および導電層２３は、同一の所定の形状にエッチングされている。また、加熱個別電極層４２上の導電層２３の所定の位置はエッチング等により除去されており、これにより、加熱個別電極層４２の発熱を電子放出部２２に対して集中させる加熱部２４と、分解能（画素数）に対応したカソード電極と称される個別電極２１ａとが形成されている。この個別電極２１ａは、例えば、直径３０μｍ程度の大きさとされ、図５および図６に示すように左右方向（印字幅方向）に一列状に整列配置されている。そ

して．各個別電極２１ａの上面には．荷電粒子（イオン）を生成するための電子を放出し得る電子放出部２２が配設されている。また．熱絶縁層１８上には．各電子放出部２２を中心とした．例えば、直径２０μｍ程度の円形の開口２５を有するゲート電極２６が適宜な厚みの絶縁層２７を介して配設され、全体として略平板状に形成されている。

【００８２】前記加熱個別電極層４２の素材としては、白金．タンタル．モリブデン、タングステン等が適している。

【００８３】すなわち、本実施例のイオン書込みヘッド１６ａにおいては、加熱個別電極層４２の導電層２３に覆われていない部位が、個別電極２１ａとされるとともに各電子放出部２２を加熱するための加熱部２４ａとされ．個別電極２１ａ上に電子放出部２２が直接形成される構成になっている。また．図６に示すように．本実施例における加熱個別電極層４２は、４個の個別電極２１ａが１組となるようにグループ化されている。この１グループ中の個別電極２１ａの数は、イオン書込みヘッド１６ａの分解能や設計コンセプト等により決定すればよく．特に、本実施例の個別電極２１ａの数に限定されるものではない。

【００８４】図８に示すように、本実施例のイオン書込みヘッド１６ａの駆動回路３１ａは．各個別電極２１ａを時分割して加熱するように構成されており、加熱用電源ＶＨが絶縁型のＤＣ／ＤＣ変換回路４３および各個別電極２１ａ毎の継断用のスイッチとしてのヒータ切換回路４４を介して各個別電極２１ａに接続されている。そして．ヒータ切換回路４４には、各個別電極２１ａに対応するフォトカプラ４５を介してヒータ切換回路４４を継断するヒータ切換信号４６が入力されるようになっている。その他の構成は、前述した第１実施例の駆動回路３１と同様である。

【００８５】このような構成とすることにより本実施例は．前述した第１実施例と同様の効果を奏するとともに．加熱部２４を兼ねた個別電極２１ａ上に電子放熱部２２を直接形成する構成とすることにより、製造工程が簡略化され製造工程の数を削減し、経済的負担を確実に低減することができるとともに、小型化を図り．熱容量を（蓄熱量）を小さくすることができるので、温度変化に対する応答性を向上させ．電子放出部２２が電子を放出するための加熱時間を短くすることができる。また、第１実施例における中間絶縁層２０を省くことができるので．温度勾配がなく、熱の利用効率を確実に向上させることができる。

【００８６】図９から図１３は本発明に係るイオン書込みヘッドの第３実施例を示すものであり、図９は要部の構成を示す縦断面図であり．図１０は図９の平面図であり．図１１はゲート電極と絶縁層を省いた要部の構成を示す平面図であり、図１２は図１１の側断面図であり、



図１３は駆動回路を示す回路図である。

【００８７】本実施例のイオン書込みヘッド１６ｂは、前記第２実施例の各個別電極２１ａに対応するようにゲート電極２６を分割した構成としたものである。

【００８８】図９から図１２に示すように、本実施例のイオン書込みヘッド１６ｂは、加熱個別電極層４２に形成された各個別電極２１ａに対応するように、絶縁層２７により分割されたゲート電極２６ａが配設されており．加熱個別電極層４２の形状もゲート電極２６ａに対応するように形成されている。その他の構成は．前述した第２実施例のイオン書込みヘッド１６ａと同様である。

【００８９】図１３に示すように、本実施例のイオン書込みヘッド１６ｂの駆動回路３１ｂは．各ゲート電極２６ａを時分割して加熱するとともに．各個別電極２１ａをグループ毎に加熱するように構成されており．潜像書込み用電源ＶＬは、各ゲート電極２６ａ毎の継断用のスイッチとしてのゲート切換回路４７を介して各ゲート電極２６ａに接続されている。このゲート切換回路４７は．ゲート切換信号４８により動作するようにされている。また、加熱用電源ＶＨは、絶縁型のＤＣ／ＤＣ変換回路４３を介して４個単位でグループ化された個別電極２１ａに接続されている。その他の構成は、前述した第２実施例の駆動回路３１ａと同様である。

【００９０】このような構成とすることにより本実施例は．前述した第２実施例と同様の効果を奏することができる。

【００９１】つぎに、本実施例の各イオン書込みヘッド１６Ａ（符号はイオン書込みヘッド１６、１６ａ．１６ｂを総称する）のゲート電極２６Ａ（符号はゲート電極２６．２６ａを総称する）と潜像担持体２８との距離Ｇを一定に保持する構造について図１４から図１８により説明する。

【００９２】図１４はイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第１実施例を示すものである。

【００９３】本実施例は潜像担持体２８として表面に誘電体層３０を有する誘電体ドラム４９を用いたものである。

【００９４】本実施例においては、イオン書込みヘッド１６Ａの印字幅方向である長手方向の両端部に適宜な接触ローラ５０．５０が配設されており．この接触ローラ５０．５０を介して誘電体ドラム４９が配置されている。そして、各接触ローラ５０，５０は、誘電体ドラム４９の表面の印字領域を避けるようにして回転自在に配設されるとともに、誘電体ドラム４９の表面と当接されている。さらに．イオン書込みヘッド１６Ａは．誘電体ドラム４９の表面の法線の方向に移動自在に支持されており．イオン書込みヘッド１６Ａの背面に配設された図示しない支持フレームと当接されている適宜な与圧スプ

リング５１の押圧力をもって誘電体ドラム４９の表面に対して所定の距離（間隔）を保持できるようにされている。なお、各接触ローラ５０の接触圧を小さくして、誘電体ドラム４９の印字領域に接触させてもよい。

【００９５】図１５はイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第２実施例を示すものである。

【００９６】本実施例においては、図１４に示す第１実施例のようにイオン書込みヘッド１６Ａに接触ローラ５０は配設されておらず、代わりに、イオン書込みヘッド１６Ａの下部に誘電体ドラム４９を清浄にするクリーニング手段としての所望のブレード５２を配設したものである。そして、ブレード５２の下方には、適宜な廃トナー受け５３が配置されている。また、誘電体ドラム４９は図１５において下方に示す転写・定着部５４にて用紙などの記録媒体５５と接するようにされている。

【００９７】このような構成によっても、図１４に示す前述した第１実施例と同様に、イオン書込みヘッド１６Ａのゲート電極２７Ａと潜像担持体２８との距離を一定に保持することができる。

【００９８】図１６はイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第３実施例を示すものであり、（ａ）は斜視図、（ｂ）は縦断面図である。

【００９９】本実施例は、潜像担持体２８として可撓性を有する無端ベルト状の誘電体ベルト５６を用いたものである。

【０１００】本実施例においては、イオン書込みヘッド１６Ａに適宜なベルト保持部材５７が配設されており、誘電体ベルト５６をイオン書込みヘッド１６Ａに対して位置決めし、イオン書込みヘッド１６Ａの図示しないゲート電極２６Ａと誘電体ベルト５６の表面との距離を一定に保させるようになっている。この場合には、誘電体ベルト５６の厚さを一定とすることが肝要である。

【０１０１】このような構成によれば、図１４および図１５に示す誘電体ドラム４９を用いる構成と比較して、イオン書込みヘッド１６Ａの位置を簡単に固定できるので、イオン書込みヘッド１６Ａのゲート電極２７Ａと潜像担持体２８との距離を一定に保持するうえで有利である。

【０１０２】図１７はイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第４実施例を示すものである。

【０１０３】本実施例は図１６に示す第３実施例と同様に、潜像担持体２８として誘電体ベルト５６を用いたものである。

【０１０４】本実施例においては、誘電体ベルト５６の表面をイオン書込みヘッド１６Ａの表面を覆うように配設したベルト保持部材５７ａ側に押しつけて距離を一定に保持させたものである。そして、本実施例のベルト保



持部材５７ａには、イオン書込みヘッド１６Ａの下流側表面５８を誘電体ベルト５６の表面に形成された静電潜像を乱さないように適宜な絶縁体からなる絶縁層５９で形成したものである。なお、イオン書込みヘッド１６Ａの下流側表面５８を誘電体ベルト５６の表面と接触しないようにするとともに、イオン書込みヘッド１６Ａの上流側表面６０に導電性の材料からなる導電層６１を形成し、誘電体ベルト５６の除電を行なうようにしてもよい。

【０１０５】図１８はイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第５実施例を示すものである。

【０１０６】本実施例は図１７に示す第４実施例の構造に、イオン書込みヘッド１６Ａの表面から流体（空気）を誘電体ベルト５６に向かって噴射させ、誘電体ベルト５６をイオン書込みヘッド１６Ａの表面から一定の高さに浮上させるようにしたものである。

【０１０７】本実施例においては、ヘッド保持部材５５ａの表面に複数の噴射孔６２を設けるとともに、各噴射孔６２を流れる空気の流量のバランスを保つための適宜なオリフィス６３を各噴射孔６２に直接する各流路６４に設け、加圧空気を各流路６４に対して供給自在としたものである。なお、誘電体ベルト５６のイオン書込みヘッド１６Ａに対する浮上量は５０μｍ程度とするとよい。

【０１０８】このような構成によれば、誘電体ベルト５６はイオン書込みヘッド１６Ａと接触しないため、イオン書込みヘッド１６Ａの表面の導電性の有無の影響を受けることがない。また、空気の圧力により誘電体ベルト５６の表面に付着する図示しないトナーを外部に排除することができるので、電子放出部にトナーが付着するという不都合を確実に防止することもできる。

【０１０９】つぎに、本実施例のイオン書込みヘッド１６Ａを用いた印字装置について図１９から図２１により説明する。

【０１１０】図１９は本発明に係る印字装置の第１実施例を示すものである。

【０１１１】本実施例の印字装置６５は、潜像担持体２８として誘電体ドラム４９を用いたものである。

【０１１２】図１９に示すように、本実施例の印字装置６５は、誘電体ドラム４９が図１９において矢印にて示す時計方向に回転自在に配設されており、この誘電体ドラム４９の周囲に、図１９において上部から時計方向に、誘電体ドラム４９上に図示しない所望の画像に対応した静電潜像を形成する潜像形成手段としてのイオン書込みヘッド１６Ａと、静電潜像を図示しないトナーにより顕像化する現像手段としての適宜な現像器６６と、トナーにより顕像化された静電潜像を用紙などの記録媒体５５上に転写するとともに定着する転写定着手段としての加圧ローラ６７と、誘電体ドラム４９を清浄にするク

リーニング手段としての適宜な金属製のブレード６８を有するクリーナ６９と、誘電体ドラム４９の荷電状態を除去する除電手段としての適宜なＡＣ除電器７０とが順に配置されて形成されている。

【０１１３】前記現像器６６には、マイナス帯電の感光体を用いた正規現像と同じプラス帯電のトナー（図示せず）が用いられており、現像器６６のスリーブ７１には、特にバイアス電圧を加えずに接地電位にて用いられる。

【０１１４】また、転写および定着は、誘電体ドラム４９に加圧ローラ６７を所望の当接力をもって当接させて記録媒体５５を誘電体ドラム４９に押し付け、前記圧接力の圧力により同時に行うようになっている。これにより、熱定着器を用いずに定着が可能となり、消費電力を減少させるとともに、ウォームアップ時間を不要とすることができる。

【０１１５】また、従来の電子写真に用いられるクリーナのブレード（図示せず）は、感光体（図示せず）が傷つき易いためにゴム製とされているが、本実施例の印字装置６５のクリーナ６９のブレード６８は、誘電体ドラム４９の強度が高いため金属製のものを用いることができ、ブレード６８の精度、耐久性を確実に向上させることができる。そして、誘電体ドラム４９の除電には、ＡＣ除電器７０によりプラスとマイナスの両極性のイオンを用いて誘電体ドラム４９の表面の電荷を効率よく中和することができる。

【０１１６】このような構成からなる本実施例の印字装置６５によれば、前述したイオン書込みヘッド１６Ａの効果と相まって、階調の再現性が極めて高い高品位の印字品質を得ることができるとともに、多種多様の用途に用いることができる。

【０１１７】図２０は本発明に係るヘッドを用いた印字装置の第２実施例を示すものである。

【０１１８】本実施例の印字装置６５ａは、潜像担持体２８として誘電体ベルト５６を用いたものである。

【０１１９】図２０に示すように、本実施例の印字装置６５ａにおいては、回転自在に支持されるとともに上下に離間状態とされた２本のローラ７２、７３が配置されており、ローラ７２，７３の何れか一方は駆動ロール、他方は従動ロールとされている。そして、それぞれのローラ７２，７３の外周面に接触するようにして誘電体ベルト５６が巻回されている。さらに、誘電体ベルト５６は、前記各ローラ７２，７３により図２０において矢印にて示す方向に走行自在とされている。

【０１２０】前記誘電体ベルト５６の下部左方には、図示しない所望の画像に対応した静電潜像を形成する潜像形成手段としてのイオン書込みヘッド１６Ａが配置されている。そして、誘電体ベルト５６の下部右方には、静電潜像を図示しないトナーにより顕像化する現像手段としての適宜な現像器６６が配置されている。さらに、誘



電体ベルト５６の上部左方には、誘電体ベルト５６を清浄するクリーニング手段としての適宜なクリーナ６９が配置されている。また、イオン書込みヘッド１６Ａとクリーナ６９との間には、誘電体ベルト５６と対向するようにして誘電体ベルト５６の表面の荷電状態を除去する除電手段としての適宜なＡＣ除電器７０が配置されている。

【０１２１】前記誘電体ベルト５６の上部には、図２０において矢印にて示す水平方向左方に走行自在とされた記録媒体５５を介して、トナーにより顕像化された静電潜像を記録媒体上に転写する静電転写としてのイオン発生器７４が配置されている。このイオン発生器７４は、イオン書込みヘッド１６Ａと同様な電子放出部２２を有する構造とされている。

【０１２２】また、記録媒体５５の走行方向下流側には、記録媒体５５にトナーを熱の作用により定着させる定着手段としての定着ローラ７５と、弾性を有する加圧ローラ７６とが、記録媒体５５を挟持自在にして配置されている。

【０１２３】このような構成からなる本実施例の印字装置６５ａによれば、前述した第１実施例の印字装置６５と同様な効果を奏する。そして、本実施例の静電転写に用いるイオン発生器７４の構造は、画像形成の必要がなく電流の均一性の要求も少ないため、電子放出部２２の数を減らしたり、イオン発生器７４と誘電体ベルト５６との間の距離を大きくしたりすることができる。さらに、記録媒体５５に対するトナーの定着を、定着ローラ７５と加圧ローラ７６とにより行うので、前述した第１実施例の印字装置６５の加圧ローラ６７を用いた場合の、記録媒体５５およびトナーを高い圧力で押しつぶすことによる記録媒体５５およびトナーの光沢の発生を確実に防止して、より高品位の印字品質を得ることができる。また、イオン発生器７４はイオン書込みヘッド１６Ａと同様に小型化するとともに低電圧、低消費電力にて動作させることができるとともに、イオン発生器７４は、図示しないコロトロン等の他のイオンの発生手段と比べて、発生するイオンの密度が高いため転写領域が限定され、転写による画像の劣化を確実に防止することができる。さらに、イオン発生器７４はイオン書込みヘッド１６Ａと同じ極性で、かつ、少ない電流にて動作させることができるので、イオン書込みヘッド１６Ａの図示しない駆動回路の電源を共用することができる。このことは、印字装置６５ａの全体の駆動回路および装置（図示せず）等の小型化を確実に図ることができるとともに、経済的負担を確実に減少させることができる。

【０１２４】図２１は潜像担持体として誘電体ベルトを用いた印字装置の他の例を示すものである。

【０１２５】本実施例の印字装置６５ｂにおいては、前述した第２実施例の印字装置６５ａのようにトナーにより顕像化された静電潜像を記録媒体５５上に転写する静

写転写としてのイオン発生器７４は配置されておらず、代わりに記録媒体５５にトナーを転写するとともに定着させる転写定着手段として定着ローラ７５と加圧ローラ７６とがポリイミド等の耐熱性の素材により形成された誘電体ベルト５６ａを挟持するようにして配置されており．この定着ローラ７５の下方に、２本のローラ７２，７３が左右に平行に配置され、前記誘電体ベルト５６ａが前記定着ローラ７５と２本のローラ７２，７３とのそれぞれの外周面に接触するようにして巻回されている。

【０１２６】前記誘電体ベルト５６ａの下部には．図示しない所望の画像に対応した静電潜像を形成する潜像形成手段としてのイオン書込みヘッド１６Ａが配置されており．誘電体ベルト５６ａの下部右方には、前記静電潜像を図示しないトナーにより顕像化する現像手段としての適宜な現像器６６が配置されている。さらに．誘電体ベルト５６ａの下部左方には、誘電体ベルト５６ａを清浄にするクリーニング手段としての適宜なクリーナ６９が配置されており、その上方に誘電体ベルト５６ａと対向するようにして誘電体ベルト５６ａの両電状態を除去する除電手段としての適宜なＡＣ除電器７０が配置されている。

【０１２７】このような構成からなる本実施例の印字装置６５ｂによれば、前述した第２実施例の印字装置６５ａと同様な効果を奏するとともに、転写時の画像の劣力をより確実に防ぎ、より高品位の印字品質を得ることができ．かつ、小型化を容易に図ることができる。なお、定着ローラ７５の代わりにサーマルヘッドのような一次元の発熱素子あるいは二次元の発熱体等を用いることもできる。

【０１２８】また、本発明は、前記各実施例に限定されるものではなく．前記各イオン書込みヘッド１６．１６ａ．１６ｂと．前記個別電極２１、２１ａと、前記各駆動回路３１、３１ａ、３１ｂとの組み合わせは．設計コンセプトにより決定すればよく、各種の組み合わせのものから選択することができる。

【０１２９】さらにまた．本発明は．前記各実施例に限定されるものではなく、必要に応じて変更することができる。

【０１３０】

【発明の効果】このように本発明のイオン書込みヘッドによれば、熱電子放出の原理によりイオンを発生させるので．低エネルギでイオンを発生させることができる。また．イオンの発生にコロナ放電を用いないためオゾンの発生がない。また、ゲート電極と個別電極、個別電極と潜像担持体の間にかける電界を制御するだけで書込みに寄与するイオン流の大きさを制御することができるので．形成されるトナー像の大きさを多階段に変化させて多階調の印画をたやすく行なうことができる等の極めて優れた効果を奏する。

【図面の簡単な説明】



【図１】本発明に係るイオン書込みヘッドの第１実施例の要部の構成を示す縦断面図

【図２】図１の一部切断平面図

【図３】本発明に係るイオン書込みヘッドの第１実施例の駆動回路を示す回路図

【図４】（ａ）から（ｊ）は本発明に係るイオン書込みヘッドの第１実施例の製造工程を説明する説明図

【図５】本発明に係るイオン書込みヘッドの第２実施例の要部の構成を示す縦断面図

【図６】本発明に係るイオン書込みヘッドの第２実施例のゲート電極と絶縁層を省いた平面図

【図７】図６の側断面図

【図８】本発明に係るイオン書込みヘッドの第２実施例の駆動回路を示す回路図

【図９】本発明に係るイオン書込みヘッドの第３実施例の要部の構成を示す縦断面図

【図１０】本発明に係るイオン書込みヘッドの第３実施例の要部の構成を示す平面図

【図１１】本発明に係るイオン書込みヘッドの第３実施例のゲート電極と絶縁層を省いた要部の構成を示す平面図

【図１２】図１２は図１１の側断面図

【図１３】本発明に係るイオン書込みヘッドの第３実施例の駆動回路を示す回路図

【図１４】本発明に係るイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第１実施例を示す要部の斜視図

【図１５】本発明に係るイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第２実施例を示す要部の側面図

【図１６】本発明に係るイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第３実施例を示すものであり、（ａ）は斜視図．（ｂ）は縦断面図

【図１７】本発明に係るイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第４実施例を示す要部の縦断面図

【図１８】本発明に係るイオン書込みヘッドのゲート電極と潜像担持体の距離を一定に保持する構造の第５実施例を示す要部の縦断面図

【図１９】本発明に係るイオン書込みヘッドを用いた印字装置の第１実施例の要部の構成を示す構造図

【図２０】本発明に係るイオン書込みヘッドを用いた印字装置の第２実施例の要部の構成を示す構造図

【図２１】本発明に係るイオン書込みヘッドを用いた印字装置の第３実施例の要部の構成を示す構造図

【図２２】従来のイオン書込みヘッドの一例を示すものであり、（ａ）は全体の形状を示す斜視図、（ｂ）は要部の構成を示す縦断面図．（ｃ）はライン電極とフィンガー電極との配置状態を示す説明図

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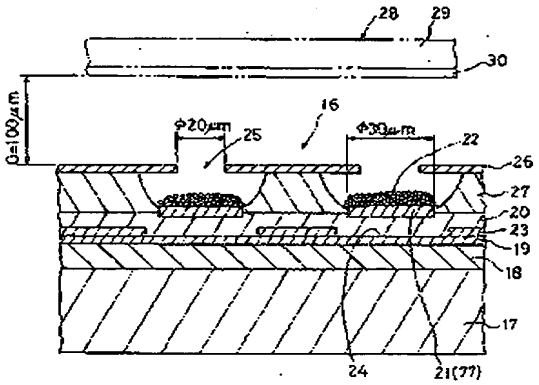
【図２３】従来のイオン書込みヘッドの他の例を示す模式図

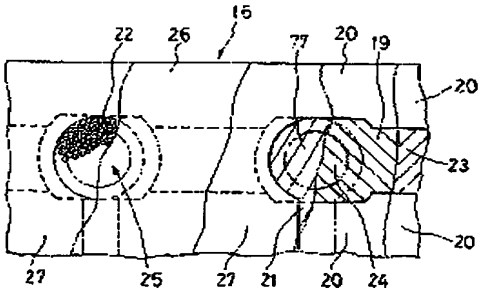
【符号の説明】

１６．１６ａ．１６ｂ、１６Ａ　イオン書込みヘッド
１７　基板
１８　熱絶縁層
１９　ヒータ層
２１．２１ａ．個別電極
＊２２　電子放出部
２３　導電層
２４．２４ａ　加熱部
２５　開口
２６．２６ａ．２６Ａ　ゲート電極
２７　絶縁層
３１．３１ａ．３１ｂ　駆動回路
＊４２．加熱個別電極層

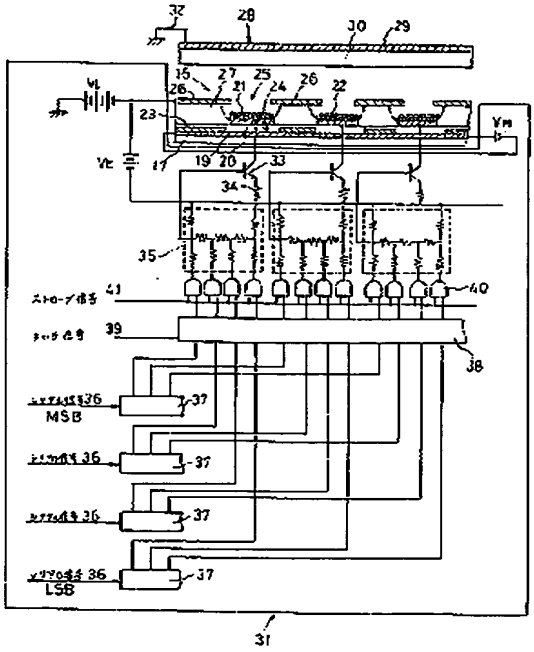
【図１】



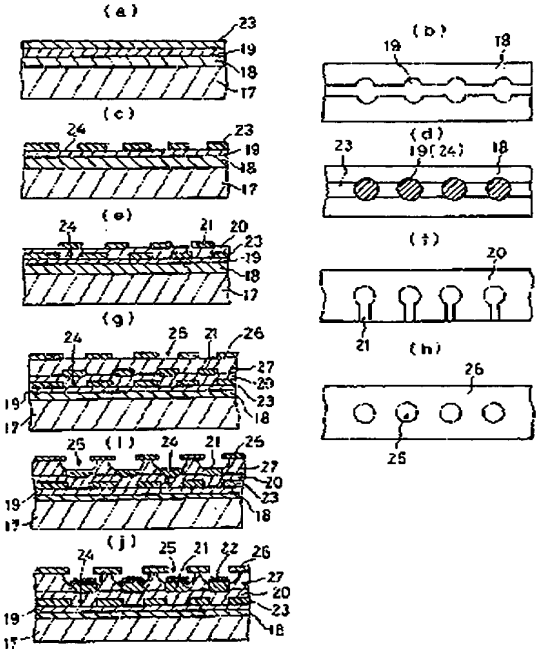

【図２】



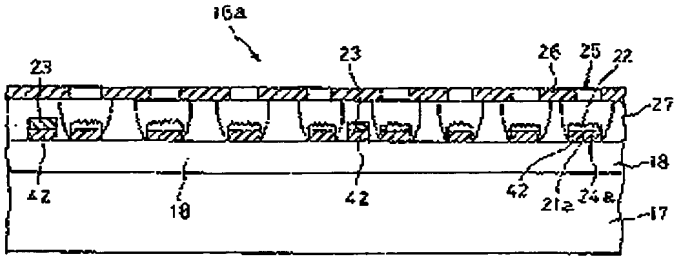

【図３】



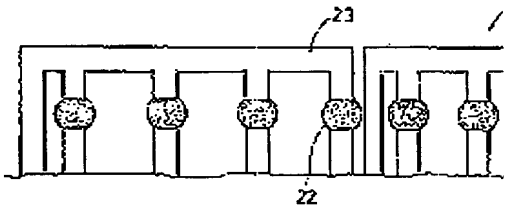

【図４】



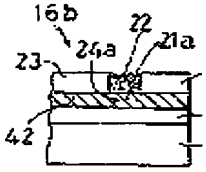
【図5】



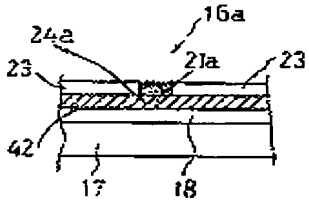

【図6】



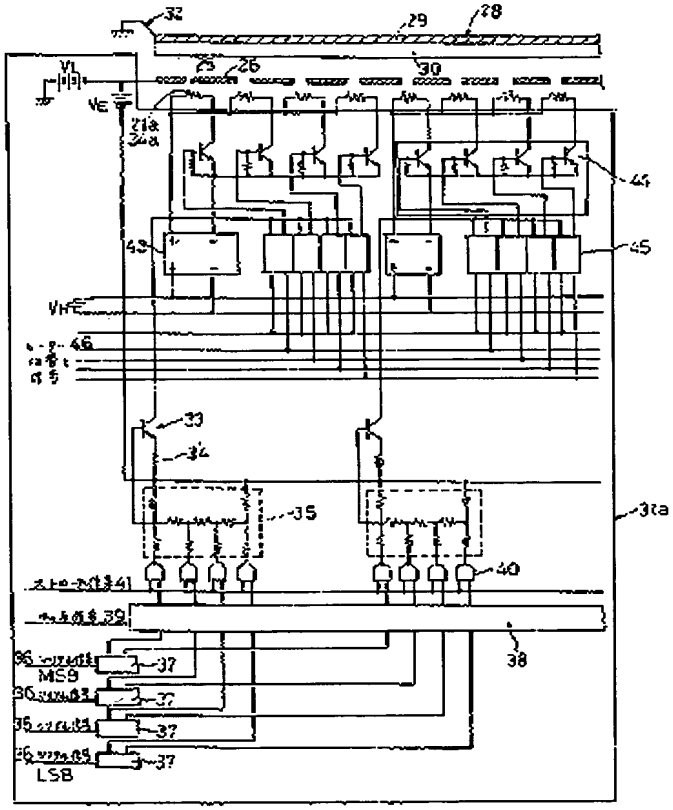

【図12】



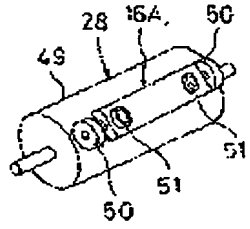

【図7】



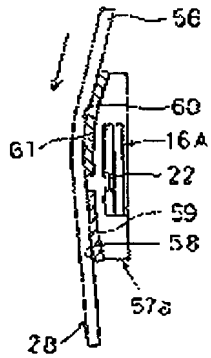

【図8】



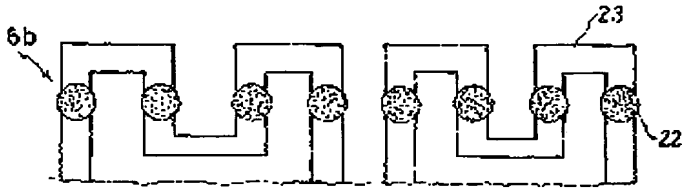

【図14】



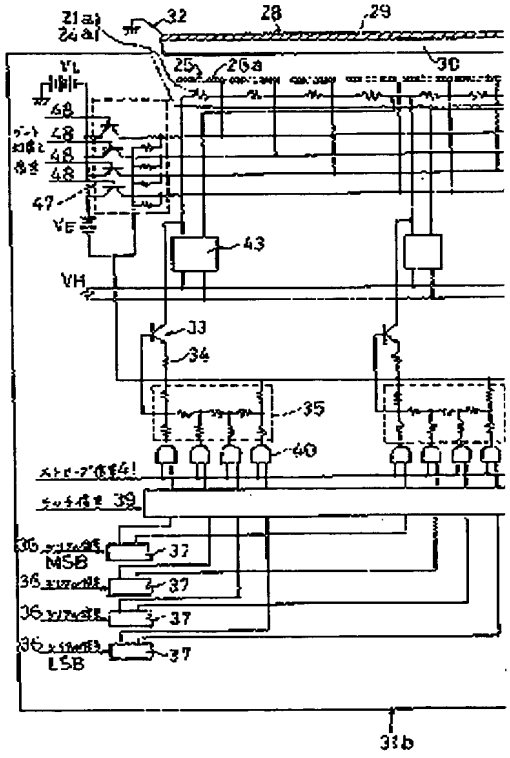

【図17】



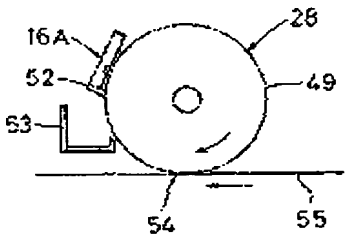
【図１１】



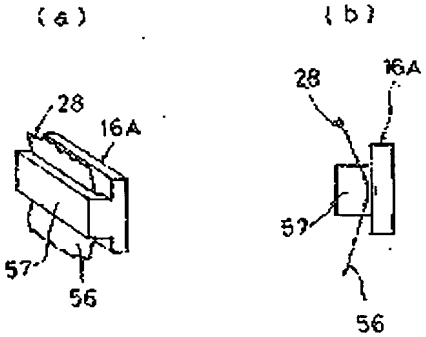

【図１３】



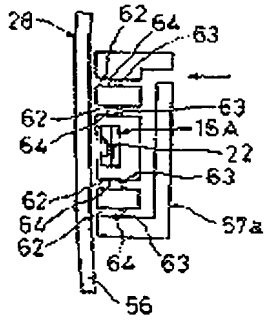

【図１５】




【図１６】



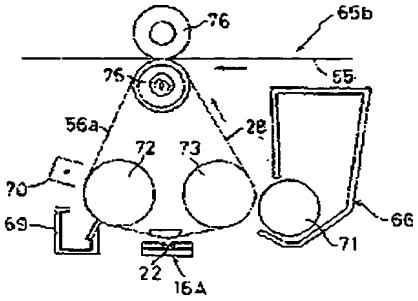

【図１８】



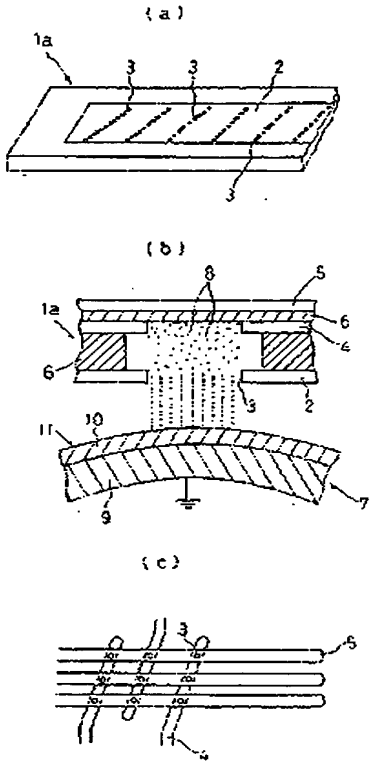

【図１９】

【図２０】

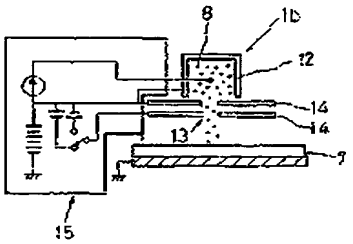
【図２１】


76
65b
75
55
56a
28
72
73
70
69
66
71
22
16A

【図２２】


(a)
1a
3
3
2
3
(b)
8
5
1a
6
6
4
3
2
11
10
9
7
(c)
3
5
4

【図２３】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